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RECONSTRUCTION OF LOCAL GOVERNMENT

IN the attention which is already being directed to the varied problems of reconstruction which we must be prepared to face in the post-war world, the significance of one fundamental group of problems which impinges on all the rest is rarely adequately stressed. Whether we are considering problems of social security and the means of implementing the proposals of the Beveridge Report, those of national health, of education, of the utilization of the land and its resources, or of trade and employment, the development or evolution of democratic institutions to serve the changing needs of our society is of critical importance. The nature and structure of the central government, its relations to local and representative institutions, the training and recruitment of the staff by which effect is to be given to the Government's policy, the place of scientific method and of the technical expert in the government machine—these are all aspects of the machinery of government which require careful study. In the light of that examination we can approach the central problem of developing a new society in which the essential measure of central planning is to be ensured while preserving the freedom of enterprise and the individual initiative and vigour which have been the secret of so much of the greatness of Great Britain in the past.

Attention is already being directed to a number of these problems by the Government. A committee of Ministers and an interdepartmental committee of permanent heads of departments is understood to be at work considering, *inter alia*, the machinery of government, and another committee has now been appointed under the chairmanship of the Financial Secretary to the Treasury to examine the general question of the training of Civil servants. Experience in civil defence and a succession of reports such as the Scott and Uthwatt Reports are enforcing reconsideration of the question of regionalism and the size of the local government units to make planning in war and in peace effective. While the democratic system of Great Britain implies the supremacy of a national government in which the interests of the parts are woven into the over-riding interests of the whole, central government cannot be successful or other than tyrannous unless the interests of the parts are maintained.

Few things show more clearly the weakness of the existing local government system of Great Britain than that it should now, after eleven years, be necessary to pass special legislation to bring under planning control "land which is not subject to a scheme or resolution under the Town and Planning Act of 1932". The duties of local authorities with regard to post-war planning will be vital and, if the main proposals of the Scott and Uthwatt Reports are enacted, will be such that they cannot avoid them. It is essential, therefore, that every effort should be made to ensure that the structure and machinery of local government is administratively sound and

served with vigour and with vision—that it fulfils its vital function of bringing to the national machinery of government the local knowledge, the personal element and responsibility which are essential if our institutions are to remain democratic and representative as well as efficient.

The structure and reform of local government have now been considered in at least three reports. That of the General Purposes Committee of the Association of Municipal Corporations on the re-organization of local government was adopted by a general meeting of the Association in London, and its recommendations have now been submitted for consideration by Sir William Jowitt's Committee on Reconstruction. A report on the "Future of Local Government" has since been published by the Labour Party, while the National Association of Local Government Officers has issued, as an expert contribution to the problems of the future of local government, an interim report on the reform of local government structure prepared by an independent committee of local government officers. The general similarity both of the conclusions of these reports as to the weaknesses of the present system and of the recommendations for reform is very striking.

The Labour Party's report and those of the Association of Municipal Corporations and the National Association of Local Government Officers remark that there are too many local authorities in Great Britain, and that the majority are too small to tackle problems of post-war reconstruction. The standard of social services is very unequal; and an undesirable distinction between town and country is made by the present structure. The National Association of Local Government Officers also emphasizes the need for securing better co-operation between local government areas in such matters as education, medical services, milk supply, highways and libraries. Either the structure of local government must be drastically amended, or an undesirable degree of control by the central government will be necessary.

As a first step it is recommended that the Government should at once set up a Local Government Boundary Commission to survey the whole of England and Wales and recommend such changes in local government boundaries as are desirable. This Commission should be a permanent body and should be constituted the tribunal for the consideration of all matters affecting local government boundaries in the future.

The importance, in any change in local government, of fusing the interests of town and country so that within each major unit there is a well-balanced grouping, actual or potential, of diversified industry, agriculture, commerce and residence is recognized by the Association of Municipal Corporations, whereas it advocates that such services as gas, transport and electricity should be part of a national scheme under public ownership, with a proper locus for local authorities in regard to prices and services. The difference between these proposals and those of the National Association of Local Government Officers appears, in fact, to be superficial rather than fundamental, and although the Labour Party's report does not specify in detail the size or area of the units to be adopted, it appears improbable that they would differ significantly from those of the all-purpose authorities advocated by the other reports.

These three reports agree in making an attempt to meet that need for greater opportunities for personal contacts between all grades of society, and machinery for fuller exchange of views and interests between them which are such important factors in the method of discussion that is the essence of a democratic system. The importance of the personal factor cannot well be overstressed. The contacts established through the War have already had a loosening and educating influence on the social structure, and we must look to this process to overcome the opposition to change as such which has already manifested itself, even in the Association of Municipal Corporations, particularly on the part of the small units which fear the loss of either power or individuality.

Two points are of fundamental importance. To the local authority we must look in large measure for the redress of the balance against any bureaucratic tendencies which may be inherent in the large-scale measures of planning which are as inevitable in post-war reconstruction as in the development of our full war effort. That objective can only be secured when we are able to obtain the services of the right type of men and women for the local authorities. The very best and not the mediocre, indifferent or self-seeker must be attracted to the local councils, and any obstacles to such enlistment must be removed as fully as possible. Local government authorities must be given the dignity and status to make that appeal. They must also prove that they deserve such dignity and status by the vision, the wisdom and the magnanimity with which they address themselves to the problems confronting them. Independence of mind, sound and disinterested judgment, rather than party allegiance, must be the hall-mark of the local councillor if our democracy is to preserve its vital character and serve the new age.

The solution of that problem may well offer some assistance in the solution of a further problem, as important in local government as in the national sphere—that of the place of the scientific or technical expert. The problem is in some respects not dissimilar from that of the control of industry and of its relations to the State, and the fundamental thinking and inquiry which offer a solution to the one problem may well be found to have a profound bearing on the other two.

It is at this point that Prof. Ernest Barker's great work, "Reflections on Government", renders such valuable service. Unless we clearly understand what is involved in a democratic system, the way in which government depends on the mutual exchange of ideas, on mutual criticism of the ideas exchanged, and on the common and agreed choice of the idea which emerges from the ordeal of interchange and criticism, we may well advance proposals which destroy the essential balance of forces and the spiritual quality of the processes on which the

democratic system depends. That danger is patent from the most cursory reading of the numerous proposals for reconstruction which have been advanced by industrial organizations, trade associations, and Chambers of Commerce, the Unilever paper "The Problem of Unemployment" being a conspicuous exception; and it cannot seriously be maintained that professional associations, albeit unconsciously, are likely to be free from fault in this respect.

It is the besetting danger of professional associations that such organization tends in time to become conservative and directed towards self-preservation rather than seeking the public good, no matter how gradual the stages by which the initial pioneering and reforming spirit is sloughed off. Against that danger professional men can and should be on their guard, and the report of the National Association of Local Government Officers, like that of the Institution of Municipal and County Engineers on Post-War Planning and Reconstruction and the earlier report of a joint committee of local sections of the Society of Chemical Industry, the Royal Institute of Chemistry and the Chemical Society to the District Commissioners for Depressed Areas in 1935, is an admirable example of the way professional associations do in practice make valuable corporate contributions to the discussion of public affairs. That difficulty is inherent in the nature of a professional association, and even from the point of view of the advancement of professional knowledge, one of the major problems is to secure that the governing body or council is sufficiently receptive and responsive to new ideas, while preserving the standards and tradition of the profession.

There is, however, a second difficulty which is important. Dr. Barker's analysis here deserves the careful consideration of the scientific worker. Within his sphere the expert has clearly the duty, as well as the right, to speak. Information, however authoritative in regard to any particular field, must, as Dr. Barker points out, necessarily be compared with, and adjusted to, information in regard to other fields. There is no issue in politics which falls within one field and one only. A like proposition might be advanced of industry. It is only in the procedure of science that particular fields are abstracted and isolated for inquiry. Moreover, information furnished by the expert in regard to his field, or by a number of different experts in regard to their different fields, is information which touches only the actual body of knowledge in the field or fields concerned. By its nature it is confined, on the whole and in the main, to measurable data. It cannot solve and is not intended to solve the problems of action, though it may set limits to action, and in that sense and to that extent determine action.

We must therefore recognize that, as Dr. Barker rightly insists, the solution of the problems of action in social and political life depends on more than scientific measurement and the results of such measurement. It depends also on the process by which different claims of right and acknowledgments of duty, which must be made sufficiently commensurable to be adjusted to one another, are set to give information about themselves, and in so doing, to reconcile themselves to one another in the certainty of a uniform and accepted law. The services of the scientific expert, as such, are thus limited to advice on the limits of action or the measurable factors involved in action, not on the action or on policy itself.

For this reason the conception of a planned State managed by experts in the art of production is alien to the mental assumptions and preconceptions on which the life of the modern State has come to proceed. For the same reason, the idea of self-government of industry is an illusion to be firmly rejected, as Mr. Herbert Morrison indicates, though not entirely for his reasons. A much closer integration of industry with the structure of society is required and, as Dr. Barker points out, and as C. E. Purdom illustrated in his suggestive book "The New Order", the solution to the problem of the relations of business and professional enterprise to the State may lie rather in the adoption, not by the State of the methods of business and industry, but by business of the methods of open discussion and voluntary agreement which have been so highly developed in the State.

The importance of regionalism in this connexion is the possibility it offers, as developments during the War have shown, of tapping more effectively the immense reserve of devoted service, initiative and capacity of leadership which had not previously been enlisted by the organs of local government and which for various reasons is unlikely to find an outlet in national politics. To utilize this material, larger units and wider powers and responsibilities in local government are essential, and a machinery in which sound administrative principles are embodied with the flexibility and adaptability required to serve the changing needs of the times. Secondly, and equally important, by integrating at the local and regional level the knowledge and services of the professional or scientific expert, it should assist in that important work of educating not only the electorate but also the councillors and others who are called upon to act on the recommendations of expert commissions in special fields.

Dr. Barker makes the point that there is a profound sense in which the process of democracy is itself scientific, and the method of procedure by inquiry, whether by Royal Commission as the Barlow Commission, or special committee as the Scott and Uthwatt Committees, is essentially scientific. Procedure by genuine discussion, starting from an adequate knowledge of the relevant facts, and proceeding, by an adequate assessment of the significance of the different data, to action based on that knowledge, bringing one claim of right into argument with another, and eliciting acknowledgments of duty to meet and face claims of right, inducing men to make for themselves compromises between different claims, and to achieve for themselves a union and a correspondence between rights claimed and duties acknowledged—this is true not only to the ideal of democracy but also to that of scientific government. The reason why, when strengthening the general method by adding the particular machinery of expert scientific commissions,

the results have been disappointing, is that we have failed to carry the process of integration and discussion to low enough levels. We have not met sufficiently fully the intensely searching demands which the complex problems of to-day make not only on the machinery of government but also on the men responsible for running the machine and the ordinary citizens whose interests it is designed to serve.

This problem of education is, in fact, the key problem. Until it is met, and the allied problem of improving the machinery of discussion at all levels, we cannot secure the essential integration and the balance which the efficient functioning of a democratic system requires. Without it the adjustment of economic claims and counter-claims, for example, can only be very imperfectly achieved at a stage preceding action by the State. The self-discipline and self-planning which are as important as State planning and State discipline also depend on an educated order, and if Dr. Barker is right in holding that the expert bodies in industry and economics or in other special fields should be advisory and consultative, they can only function efficiently when this condition is fulfilled.

Planning in a democracy is necessary, but it must be compatible with the liberty of a general society of free minds. In ensuring that condition, local government has a vital part to play. The proposals advanced in these reports for strengthening local government to meet the new conditions have a strong claim on the interest of scientific men, who should be stimulated to take their full share individually in such work, and individually and collectively in the thinking that has yet to be done to modify or strengthen our political institutions where needed to ensure that in the new order the essential human freedoms are served with all the knowledge and experience which science can bring to bear.

TIME BASE CIRCUITS

Time Bases (Scanning Generators)

Their Design and Development; with Notes on the Cathode Ray Tube. By O. S. Puckle. Pp. xii+204+5 plates. (London: Chapman and Hall, Ltd., 1943.) 16s. net.

THE cathode-ray tube has found its chief application, in the hands of the research worker, in connexion with the study of the time-variation of voltages and currents. In such applications, the quantity under observation produces a deflexion of the spot on the screen of the tube, usually in a vertical direction, while the application of a steadily changing voltage makes the spot move in a perpendicular direction. The resultant movement of the spot traces out a Cartesian graph of the variation with time of the quantity being studied.

The circuits producing the steadily changing voltage which makes the spot execute the 'time-axis' or 'time base' have been called 'time base circuits' or, more shortly, 'time bases'.

The book under review deals with the design and properties of circuits which have been developed, both for this purpose and for the similar object of making the spot traverse or *scan* the screen of the cathode ray tube in connexion with television. In the latter application the circuits are sometimes called scanning generators—the name adopted as a part of the title of the book.

The requirements of these two applications differ only in that, in the case of the television circuits, stress is laid on simplicity coupled with a speed of traverse the irregularities of which are inappreciable to the viewer, whereas in the 'research' circuits simplicity is not so important.

The majority of time-bases depend on the exponential rate of charge or discharge of a condenser which is in series with a resistance and a source of electromotive force, the periodic charge (producing the working stroke of the traverse) and discharge (producing the fly-back) being effected by an electronic switch or 'trigger circuit', which is usually a type of 'relaxation oscillator'. The action of the trigger circuit is often initiated by a 'synchronizing' or 'locking' impulse in order that the time base may start at a desired instant. The output from the time base circuit may not be sufficiently linear, that is, the speed of movement of the spot may not be sufficiently constant. To cure this defect 'linearizing' circuits are added. Further, the output may be insufficient in amplitude or unsuitable in form, and may cause aberrations in the trace on the cathode ray tube. Properly designed amplifier stages may be used to overcome these troubles.

Information on the design of time bases is scattered throughout reports on electrical, medical and other research, being often mentioned in passing, as a detail of the equipment used, and therefore difficult to find. The author has performed a very useful service in collecting, in one book, a large amount of material on time bases (accompanied by clear exposition and by criticism), to which he has added some account of his own work in certain aspects of the subject.

Some idea of the scope of the book may be gained from the following summary.

After classifying the different types of time base the author shortly disposes of the simple time bases produced by a sinusoidal source and devotes the rest of the book to the (ideally) 'linear' time base, in which the velocity of the spot is constant. As mentioned above, the movement of the spot is usually caused by an exponential voltage charge. The author, in a chapter entitled "Linearization of the Trace", describes certain artifices which make the rate of movement of the spot more constant. This chapter is prefaced by a discussion and definition of linearity, and includes an ingenious circuit in which feed-back increases the degree of linearity to an extent equal to the stage-gain of the valve. A chapter devoted to trigger circuits which control the operation of the time base condenser describes circuits such as the transitron, 'flip-flop', and Schmitt's trigger circuit (a variant of a circuit described by G. T. Evans in 1931).

The importance of applying the time-base-producing voltages symmetrically to the cathode ray tube is described in a chapter on push-pull deflexion, and the book ends with a description of methods of synchronizing or locking time bases to the frequency of occurrence of the phenomena under observation and with a note on the use of time base circuits for frequency division—a by-product of their usual application.

Some useful appendixes are added, dealing (among other things) with practical notes on the use of a cathode ray tube, linearity of exponential variations, the author's work in clearing up certain anomalies in the operation of gas-discharge valves, 'differentiating' circuits, and square wave generation (including the use of an artificial line for producing brief pulses). A full table of contents, the clearness of which is enhanced by the use of four different type faces, a short bibliography and an index are included. The circuit diagrams which accompany the descriptions are numerous and clear.

The reviewer, while realizing that an author in war-time is subject to limitations of paper supply, thinks that the value of the book might be enhanced by certain additions. First: the author's standing in the 'time base' world fits him well for producing an authoritative glossary, which would include words such as scan, trace, firing, locking, square pulse, etc. Secondly: in his outline of the action of the multivibrator, the author adheres to the usual description, in which the back-coupling between the two valves produces a 'cumulative' effect which leads to instability. This simple description would lead to the idea that back-coupling *per se* leads to instability, whereas a gain 'round the circuit' greater than unity is a necessary condition. A more satisfying explanation is that the circuit (at first stable) is caused to arrive at such a condition that the gain is greater than unity, and instability results. A more comprehensive account, in terms of positive feed-back, is given in the chapter on trigger circuits. Thirdly: the author illustrates some descriptions with "Cyclograms" which show the path of the spot resulting from the simultaneous application of two voltages to the two deflecting systems. The time-variation can be inferred qualitatively by studying the relative thickening of the slowly moving traces, but the reviewer suggests that this information could, with advantage, be introduced quantitatively by modulating the beam by means of a square wave of known frequency. L. BAINBRIDGE-BELL.

PLANT GEOGRAPHY OF THE MEDITERRANEAN REGION

Das Pflanzenkleid der Mittelmeerländer

Von Prof. Dr. M. Rikli. Lief. 1. Pp. 128+17 plates. 7.50 francs. Lief. 2. Pp. 129–240+17 plates. (Bern: Hans Huber, 1942.) 9 francs.

IN view of the importance of the Mediterranean region as the centre of origin of a great number of cultivated plants (Vavilov, *Trudy prikl. Bot. Leningrad*, 16, No. 2, 242; 1926) and of its interest to botanists and agriculturists in South Africa, parts of Australia, California and other localities where somewhat similar climatic conditions prevail, a detailed, documented account of Mediterranean plant geography such as that now being published by Prof. M. Rikli, of Zurich, himself a specialist in the subject, is much to be welcomed.

The work is appearing in serial parts containing approximately 120 pages. Two parts have been received in Great Britain. Although unfortunately no prospectus showing the ultimate extent of the book is to hand, a study of the existing fascicles sufficiently indicates its indispensable nature for the library of the botanist and the ecologist.

The matter treated in the first two parts comprises a definition of the Mediterranean region and its limits, with some reference to transitional zones; its climatic conditions; the life-forms of the Mediterranean flora and their phenology; and the beginnings of a classified account of the flora itself. One chapter is devoted entirely to a study of the olive tree, described as not only the most valuable tree of the region economically, but also the principal indicator of typical Mediterranean conditions, for where the olive tree ceases to appear, there is the boundary of the true Mediterranean flora. The seventh chapter, of which only a part (pp. 168–240) is included in the issues under notice, deals with the natural land of the region, treating first six groups of formations found in land capable of cultivation but not yet under culture. These groups are the forest, large and small shrub and rock gorge formations, and the less important marsh and strand formations.

In defining the Mediterranean region, three main divisions are recognized: (1) North Africa, comprising the Atlas countries (Morocco, Algeria, Tunisia) and the Barka countries (Tripolitania, Cyrenaica, Marmarika and Egypt); (2) southern Europe; and (3) near Asia. The last-named section is again divided into Orient I (Asia Minor, Cyprus, Syria, Palestine, Sinai Peninsula) and Orient II (the Caucasus countries; Ciscaucasia and Transcaucasia, part of Armenia, the southern shore of the Caspian). Orient III (Arabia, Mesopotamia, Iran, Irak, etc.) lies outside the region under consideration. An imaginary line dividing east from west runs from Trieste down through the Adriatic and Mediterranean east of Malta and crosses the African coast at the Tunisian-Tripolitanian frontier: it is noted, however, that this division is of an arbitrary nature, while on the north and south the region is fairly sharply defined by natural frontiers, namely, mountain ranges and deserts. The eastern limits of the region are the most debatable; but, although the Caucasus lands and the northern shores of the Black Sea no longer exhibit much of the typical Mediterranean flora, it is considered that they should be included in the region, as the Black Sea forms actually a part of the Mediterranean Sea, while the Caspian Sea was in geologically recent times in connexion with the Black Sea and thereby with the Mediterranean also. At the same time, the relativity of any plant geographical limits is stressed, and attention is directed to the marked contrast of the eastern part of the region, with its more continental climate and rainfall lower than in other parts of the Mediterranean, to the extreme west, where the climate is maritime and characterized by humidity and very abundant rainfall.

Of great importance for the especial character of the flora is the annual rainfall and its seasonal distribution. On the whole, the amount of the annual rainfall diminishes steadily from north to south, and, for the same latitude, from west to east. The actual quantities are not so low as the character of the vegetation might suggest—the mean figure given is indeed 9·3 per cent higher than that for Germany—but the greater warmth and drier air of the Mediterranean region, together with the drought-hardened soils, greatly increase the proportion of evaporation and run-off and reduce that of the moisture available to the plants. Seasonal distribution, however, is the weightiest factor governing the preponderantly

xerophilous nature of the Mediterranean flora, for during the summer there is little or no rainfall, so that this season constitutes for the plants a season of rest. Atmospheric humidity, like the amount of rainfall, also diminishes from north to south and from west to east; and especially in summer, at the time of the greatest evaporation, the air is extraordinarily dry. Rainfall is generally of a torrential nature and of short duration. The temperature of the Mediterranean region is distinguished by a remarkable degree of uniformity, by high winter temperatures and generally very moderate minima, the average minima ranging from + 7·3° C. at Alexandria to −7·2° C. at Montpellier. Winds, general and local, the light climate—described as a "photochemical climate" akin to the intensity recorded for alpine heights—and the microclimate have also their part in conditioning the special nature of the Mediterranean flora. These life conditions are fully dealt with in Chapter 4.

While the great majority of the Mediterranean plant types, differing so greatly in habit, can be described as xerophytes, the following fifteen groups are distinguished and described: therophytes, geophytes, sclerophyllous plants, compass plants, trichophytes, secretory plants, armoured plants, microphyllous plants, virgate plants (Genista spp., *Spartium junceum*, etc.), thorn bush (thorns constituting an adaptation to drought and great intensity of light rather than a protection from animals), chamæphytes and hemicryptophytes, cushion plants, xerophytic Gramineæ, succulents, osmophytes.

The portion of the seventh chapter now at hand contains the section on the natural forests of the Mediterranean region—mainly oak, notoriously sparse and composing only 10–30 per cent of the total area—and a part of the section on the woods and large bush formations. Of particular interest, perhaps, is the account (pp. 221–236) of the widespread Mediterranean evergreen formation, the maquis. There are discussed its origin, its botanical composition, the conditions governing its existence and the modifications and displacements brought about through human activity and especially through large-scale burning for pasture. From personal observations in Corsica, it is estimated that the greater part of the evergreen bush of that island is burnt on an average once every six to ten years, "an expression of the age-long strife between the pastoral population, which desires to enlarge its grazing areas, and the forester".

The section on the pseudo-maquis, a more winter-hardy xerophytic evergreen bush formation occupying montane and submontane regions, is as yet incomplete.

References to the literature are placed at the end of chapters, and the work is copiously illustrated by maps and photographs. G. M. ROSEVEARE.

ROTATION AND THE PLOUGH

The Way of the Land

By Sir George Stapledon. Pp. 276. (London: Faber and Faber, Ltd., 1943.) 12*s*. 6*d*. net.

SIR GEORGE STAPLEDON is perhaps the greatest living example of a type of scientific mind which with increasing academic specialization and on account of the change in the nature of scientific inquiry towards the quantitative rather than the qualitative is less common than it was. He might be compared with the Darwins, John Bennet Lawes, and K. Timiriazev [see p. 138 of this issue] in being well known beyond the walls of universities and in having found his best inspiration outside the laboratory and with a social rather than a theoretical leaning. His bent may be called the generalizing descriptive, distinct from the taxonomic and the quantitative; it is clear from this book that he prefers the energetic to the inductive, and H. Bergson to R. A. Fisher. His greatest admiration for a man of science is bestowed on G. Turesson, the Swedish student of plant ecotypes.

Sir George is an appreciated popularizer of an idea, or rather a close-linked series of ideas, arising out of the study of the natural history of plants and intended to raise the status of his country's agriculture. These ideas are so well known that it is almost superfluous to mention them here. The book will be useful to the agriculturist who is unaware of Sir George's thesis—if there is any such person; it will be more useful still to the person who thinks he knows about the ploughing-up and rotation of grassland, and wishes to refine his knowledge.

The book consists of twenty-two essays and addresses dating from 1912 to 1942. Most of them have not been published in full before. The presidential address to the Agricultural Section of the British Association is included here, and deserves re-reading because it brings to light the curious neglect of the study of rotation. It suggests other instances of neglect of scientific consideration of problems of actual farming, such as give openings to critics of the organization of agricultural science. Together, the essays form what the publisher describes as the autobiography of a point of view. It is the point of view of an explorer eager to tell of what he has seen, and of what can be done, in a new land; but his *terra incognita* lies at home. He has discovered the grasslands of Britain, some of them high up, where few besides the shepherd and the farmer ever tread; others, low down, and traversed by the railways and hunting packs of central and southern England. He has discovered the potentialities of the often-overrated grazing land; how there is scarcely any that cannot be improved and made farmable by being ploughed up and wisely managed. For once, the better will be the friend, and not the enemy, of the good. Characteristic is the observation that much land that was permanently hayed has had its fertility transferred via the stables of the big towns to the market gardens, which are sinks of fertility.

The ideas of Stapledon actually affected only a small proportion of the vast campus over which he would like to operate: a few hundred acres at most owe their improvement directly to him. But the seed was only dormant. There cannot be much doubt that the way of the land in current agricultural policy is in part its fruit: to this Churchill among agronomists his hour came. The present value of this book is difficult to assess. To some, the book may seem redundant, but perhaps there is an implied tribute in that. The value of this work will almost certainly be great to the agricultural historian of fifty years hence, who will see clearly developments hidden from us either because they are contemporary or because they have not yet come fully to fruition.

HUGH NICOL.

Fluid Mechanics and Statistical Methods in Engineering

By Hugh L. Dryden, Theodore von Kármán, Anton A. Kalinske, Thomas K. Sherwood, Samuel S. Wilks, Walter A. Shewhart, Leslie E. Simon, Roscoe Pound. (University of Pennsylvania: Bicentennial Conference.) Pp. v+146. (Philadelphia: University of Pennsylvania Press; London: Oxford University Press, 1941.) 10s. 6d. net.

THE book is divided into two sections, each consisting of separate papers of a mainly expository character. The best idea of such heterogeneous material will be conveyed by enumeration. The first section, "Fluid Mechanics", contains four papers. "The Role of Transition from Laminar to Turbulent Flow in Fluid Mechanics", by H. L. Dryden, gives an introductory survey of the various aspects of the problem of transition, with diagrams. "Problems of Flow in Compressible Fluids", by T. von Kármán, gives a short review of a few problems connected with high-speed flow and high-speed motion of solids in fluid media with particular reference to aeronautics and exterior ballistics. "Investigations of Liquid Turbulence and Suspended Material Transportation", by A. A. Kalinske, gives an account of transportation of suspended matter in an open channel. "Mass Transfer and Friction in Turbulent Flow", by T. K. Sherwood, gives a brief discussion of various theories proposed in this connexion.

The second section, "Statistical Methods in Engineering", also contains four papers. "Contribution of Mathematical Statistics to Scientific Methodology", by S. S. Wilks, gives an account of the principles and scientific significance of the methodology for making predictions from observations, together with the appropriate measurements of confidence. "Contribution of Statistics to the Science of Engineering", by W. A. Shewhart, gives an outline of the theory of repetitive operations on order to provide the engineer with a method of regulating such operations to the best advantage. "Contribution of Statistics to the Development and Use of Purchasing Specifications and Standards of Quality", by L. E. Simon, outlines the genesis of a statistically sound acceptance specification. "The Relation of Statistical Quality Standards to Law and Legislation", by R. Pound, inquires whether statistical methods cannot be used to point the way in certain aspects of legislation.

In so far as the articles are expository they may appeal to the general scientific reader interested in such matters; indeed it is difficult to see for whom else the collection can be intended.

Apparitions

Being the Seventh Frederic W. H. Myers Memorial Lecture, 1942. By G. N. M. Tyrrell. Pp. viii+123. (London: Society for Psychical Research, 1943.) 3s. 6d.

IT might be thought that Mr. Tyrrell, in choosing the subject of apparitions for the seventh Frederic W. H. Myers Memorial Lecture, was returning to that kind of anecdotal psychical research which is gradually giving way to a more quantitative and philosophical approach. Such, however, is not the case, for in this lecture Mr. Tyrrell is approaching the subject of apparitions from the only angle from which such phenomena can be properly approached, namely, that which supposes such appearances to be in general hallucinations of a peculiarly interesting and important kind. Mr. Tyrrell supposes that apparitions are caused by the existence of what he calls "idea patterns", by which he means images which are the direct expressions of the agent's ideas and which are externalized as full-blown hallucinations. What is seen is, to use Mr. Tyrrell's phrase, merely "a psychological marionette", the outward expression of a drama which has been thrown into sensory form, and thus a close and detailed study of its production might be expected to throw considerable light on the various strata making up the human personality. It is true that the facts of collective hallucination and similar experiences, which are apparently shared by both children and animals, are not altogether easy to fit comfortably into the framework Mr. Tyrrell has constructed for them; but generally speaking it would be a mistake to lay too much emphasis on incongruities and difficulties which may eventually be found to be superficial rather than fundamental. What Mr. Tyrrell has done has been to direct attention to the need of examining apparitions from the psychological and philosophical points of view; and such an attempt can only be made by those who have rid themselves of naïve assumptions bred from prejudice and lack of acquaintance with the facts. Such an approach is to be welcomed and will, it is hoped, be extended to other branches of the studies comprised under the comprehensive title of psychical research.

An Encyclopædic Dictionary of Science and War

By Surgeon Rear-Admiral C. M. Beadnell. Pp. xviii+293. (London: Watts and Co., Ltd., 1943.) 25s. net.

IT is in the nature of things that one is more intensely critical of dictionaries than almost any other documentary material, so let it be said at once that the present volume is a remarkable achievement for a single author. He is well known as a lifelong student of ballistics, and, carefully avoiding the ground recently covered by other technical dictionaries and encyclopedias, has contrived to concentrate on ballistics and such sections of chemistry as explosives, war gases, and the elements, as have primary functions in war-time. Where desirable, extensive tables give the data in easily accessible form, with one dire exception: if one requires any of the mass of information which is given about an element, one is retarded by the time required to disentangle each item, since for each element the items run on. There are inevitably some obvious misprints in these masses of data. Much space is saved for useful information by a considerable series of contractions, which are listed separately.

While one might insist that the volume be titled "Science in War" instead of "Science and War", one can also blame the author in not being scientific in his diverse use of dimensions. Any magnitude is inevitably accompanied by its translation from, say, inches to centimetres, miles, etc., seconds into hours or years. The author might consider being more scientific in a new edition by adopting throughout the metric system in multiples of 1,000. The inevitable simplification of units in the future would be accelerated if authors of such standardizing books as the present show a lead and indicate the public usefulness of the metric system.

L. E. C. HUGHES.

EDUCATIONAL RECONSTRUCTION

THE long-awaited White Paper* setting forth in full the Government's policy and intentions in the matter of educational reform is now before the public, and will no doubt be discussed from every point of view. For the moment we confine ourselves to a summary of its principal proposals, reserving further comment for a later date. The cautious mode of procedure adopted by Mr. Butler commands general approval. The teachers, the administrators, the churches, the parents, and the existing local authorities may now know just where the Government stands, and are free to criticize before an Education Bill is introduced in Parliament. No one who recalls the stormy scenes of 1870 and 1902, and the fate of some of the best proposals of 1918, can wonder at Mr. Butler's studied patience and wariness. As in 1918, the fact that the coming Bill will be introduced on behalf of an all-party or non-party Government will facilitate its passage through Parliament, but it is to be hoped that it will do so with ultimately better results.

The Paper envisages national education in three stages—primary education, secondary education, and further education. The traditional term 'elementary', which has long been a rather absurd anachronism, will now disappear from the official vocabulary. No longer will it be implied that teaching the 'elements' of the three R's is almost the *raison d'être* of the people's schools, and no longer will the parent's duty be confined to causing his child to be efficiently instructed in the three R's. His duty, as laid down in this Paper, will be "to cause his child to receive efficient full-time education suitable to the child's age and aptitudes" (par. 24).

Primary education is defined as covering the period up to eleven or twelve. The age for compulsory attendance at school, namely, five, will remain as now. Primary education is to include the nursery school, for children from two to five, the infants' school, for children between five and seven or eight, and the junior school, for children between seven or eight and eleven or twelve. Here we seem to have a convenient fixing of terminology which was necessarily left rather fluid in the Hadow Report on the primary school. There is now to be a comprehensive stage of primary education, of which the last part is the junior stage. As to nursery schools, the weak word "may" is to be replaced by the mighty word "shall". Otherwise expressed, "it is proposed to substitute for the present power of local education authorities a duty to provide, or aid the supply of, such nursery schools as in the opinion of the Board may be necessary". Good reasons are given for preferring self-contained nursery schools to nursery classes attached to infants' schools. Though no special prominence is given to the subject, the proposed provision for nursery schools is, for its social consequences, probably the most far-reaching thing in the whole document. Good reasons are again given for separate infants' and junior schools, wherever the numbers justify the arrangement. The psychological differences between the two stages are in general a part of "what every woman knows" and many men also. The very large classes in many infant and junior schools are condemned unsparingly as affording "not education but mass production".

One of the most striking passages in the White Paper, also far-reaching in its educational consequences, is the condemnation (par. 17) of the present arrangements for transition from the junior schools to the post-primary schools. "There is nothing to be said in favour of a system which subjects children at the age of eleven to the strain of a competitive examination on which not only their future schooling but their future careers may depend. Apart from the effect on the children, there is the effect on the curriculum of the schools themselves. Instead of the junior schools performing their proper and highly important function of fostering the potentialities of children at an age when their minds are nimble and receptive, their curiosity strong, their imagination fertile and their spirits high, the curriculum is too often cramped and distorted by over-emphasis on examination subjects and on ways and means of defeating the examiners. The blame for this rests not with the teachers but with the system." So it is proposed to make a clean sweep of this unhealthy form of competition, a competition which is pernicious at any stage.

Coming now to secondary education, we observe that there are to be three types of secondary schools, to be known as grammar, modern and technical schools. The grammar school will be of the type represented by the present secondary schools, and the modern schools will be of the type represented by the existing central and senior schools. It is fully recognized that there are, in areas where re-organization has taken place, enormous differences between the two as to premises, equipment, staffing and what are called amenities but could often be more correctly described as decencies. Meantime the word 'secondary' is to be hopefully applied to both types, as well as to the technical schools, which have achieved so much success since they were started in 1905. The intention to raise the leaving age to fifteen without exceptions as soon as possible after the War, and to sixteen at a later date, will of course have an important effect on secondary schools of all types. A child who is found, say, at the age of thirteen, to have been wrongly placed at the age of eleven may be transferred to a school more suitable for his bent and talents.

From the fact that religious education and the position of the voluntary schools occupy far more space than any other topic, amounting to nearly a quarter of the whole Paper, it may be inferred that the old difficulties have been fairly faced. One thing is clear. There is a very general wish, not confined to representatives of the churches, that religious education should be given a more defined place in the life and work of the schools. The practice now prevailing in most primary and secondary schools of beginning the day with a corporate act of worship will now receive statutory sanction and be universal, but with due regard to the rights of conscience. In what we now know as provided schools the religious instruction will usually be in accordance with an agreed syllabus. No unwilling teacher will be compelled to give such instruction, and no teacher will be penalized for not giving it. Also, it is at last recognized that there is no valid reason why different principles should be applied to inspectors and teachers. The inspection will be limited to agreed syllabus instruction. As we have intimated, much space is

* "Educational Reconstruction." Cmd. 6458. (London: H.M. Stationery Office, 1943.) 6d. net.

devoted to the embarrassing dual system, including its history, and the reasons why the simple solution reached in Scotland is inapplicable south of the Tweed. A plan is described by which the degree of public control will be approximately proportioned to the amount of financial support provided from public funds.

The principles of the Act of 1918 relating to day continuation schools are to be adopted to meet the requirements of the post-war world, but the term "day continuation school" is to be abandoned, and the institutions required for the purpose will be referred to generally as 'young people's colleges'. "It is important," says the Paper, "to make clear that what is in view is no 'going back to school', a mere extension on a part-time basis of previous full-time schooling, but the entry on a new phase of life and development." Certain basic elements will be included in the training, and when these have been met the remaining hours may be devoted to a variety of subjects according to the needs and capacities of each individual.

The field covered by the term "further education" is obviously a wide one. The provision of further education is at present a power and not a duty of local authorities, and despite what many authorities have done, technical education has not made the advance which the needs of a highly industrialized community demand. To some extent the industries themselves are alive to the need of ordered systems of training, and by consultation with the Board of Education and the Ministry of Labour it is hoped to build up in each major industry a system which will be accepted and applied not by individual firms here and there, but on a national basis throughout the industry.

The White Paper emphasizes that without provision for adult education the national system must be incomplete. After all has been said about other forms of education, it is "within the wider sphere of adult education that an ultimate training in democratic citizenship must be sought". While the more serious and solid studies that have formed the backbone of adult education at its best must be maintained, there will be room for new methods and new approaches to meet new demands. Upon this question the education services that have operated in the Forces have thrown much light.

Mention is made in the Paper of the Youth Service brought into being to extend the recreational training of young people by assisting the voluntary organizations. In spite of the restrictions imposed by war conditions on the supply of leaders, premises and equipment, the service has shown a remarkable expansion. "There is now a far higher proportion than at any previous time of young people associated with healthy leisure-time training and recreation without compulsion or regimentation of any sort." The section on health service, we may add, extends existing facilities for securing the physical well-being of children and young persons.

On the subject of access to the universities, it is noted that the path of the poor scholar has been made broader and less difficult during the last twenty years, and that the expenditure by the Board through the system of State scholarships and by the local education authorities through their major awards has been a profitable investment, judged by the successes achieved by the beneficiaries. None the less, the system is inadequate. Again the difference between giving a power and laying a duty upon a local authority obtrudes itself, leading to a wide disparity in the opportunities of poor students. Upon this question the Norwood Committee's advice is now available for the guidance of the Government. The Paper hints that this is not the only direction from which provision may be made for highly promising persons after the War.

At various points in the course of the Paper the reader is reminded that legislation can do little more than prepare the way for reform. "It will rest with the Board and the local authorities, and, not least, with the teachers working in the schools, to translate its aims into practice." All along the line, through primary and secondary and further education, it is obvious that more, a great many more, teachers will be needed. But, says the Paper, it is not merely a larger number of teachers that will be required, but a larger number of the right kind. "It would be deplorable if the necessary corps of teachers could be obtained only at the expense of lowering existing standards. It depends almost entirely upon the quality of those who staff the schools whether the reforms proposed will be merely administrative reforms or whether they will, in practice, work out as real educational reforms." These questions of the supply and training of teachers are being investigated by the McNair Committee, and the recommendations of that Committee are awaited. Meantime the Paper points out frankly what is "patently wrong" with the present system of recruiting and training teachers, and some of the reasons why an expert inquiry was long overdue. The field of recruitment is narrowly limited to those boys and girls who remain at grammar schools until 17 or 18, and the educational history of teachers is nearly all of one uniform pattern. As to the period immediately following the War, "there are many men and women now serving in the Forces or elsewhere whose experience and devotion would greatly enrich the education of children".

The Paper concludes with some plain speaking on the subject of "independent schools", that is, schools which stand apart from the State system. The expression includes all manner of establishments, from those which are excellent to those which, according to the report of a Departmental Committee in 1931–2, are so defective as to be harmful to the physical and mental welfare of the children, and those —a larger number—which are seriously deficient and inefficient. At present anybody, whatever his or her qualifications, can start an independent school in any building and, unless the use of the building constitutes a nuisance under the public health acts, its improvement or closure cannot be obtained. The Paper proposes that all independent schools must be open to inspection by the Board and registered on a list kept by them, and that schools found to be defective shall be suitably dealt with. It is characteristic of our national feeling in such matters that, in order to ensure that reasonable liberty shall remain for those schools outside the public system, the proprietor of a condemned school will have the right to appeal to an independent tribunal against the Board's decision.

Such are the main contents of a document, remarkable alike for its comprehensiveness and its lucidity, which will provide thoughtful citizens, both young and old, with food for thought during the next few months. No doubt much of further interest and value will accrue from the Parliamentary debates which will follow.

ADOLESCENCE AND SOME PROBLEMS OF YOUTH TRAINING*

By PROF. C. W. VALENTINE
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IN a short article one can of course attempt no comprehensive survey of the psychology of adolescence. I propose merely (i) to supply further evidence on some points in view of the revived interest in the training and guidance of youth, (ii) to question one or two assumptions usually made, and (iii) to indicate certain basic problems.

As my first section below gives results gathered by means of questionnaires, a word may be said on the scientific value of such inquiries. Provided that these reports are anonymous, as in my own inquiry, I am sure that one can gain valuable information from them. In using questionnaires, however, one must beware of distributing them widely and then only dealing with the selected records of those who have taken the trouble to reply. Such are liable to be those who have something particularly interesting to report of their adolescence, or those who enjoy the opportunity of writing about themselves. The danger is avoided when one presents the questionnaire to a group of people and gets replies from every one, though of course we have to bear in mind the selected nature of the class itself, in this case university graduates. My own questionnaires were filled in by 220 graduate students during the years 1926, 1927, 1930 and 1942. Similar inquiries among students and wage-earners were made by Prof. Olive Wheeler[1]. In addition, I had some hundred or so confidential essays from students based largely on their own adolescent experiences, which were astonishingly frank. (I guaranteed that no one should read them except myself.)

The students (120 women and 100 men) were asked whether they had experienced during adolescence a marked intensification of various kinds of emotional experience or a decided change in certain attitudes, and to give the ages at which these changes began and ended. I give some of the most interesting results.[2] Marked increases or intensifications were reported as follows: as to religious experiences, women 74, men 78 per cent; interest in a member of the same sex (something approaching 'love'), women 72, men 50 per cent; aversion from opposite sex (at an earlier period usually) women 45, men 45 per cent; moods of intense dejection, women 76, men 61 per cent; contemplation of suicide, women 29, men 38 per cent.

There is general agreement that some of the main characteristics of adolescence, especially the instability of emotions and impulses, are closely connected with, if not entirely dependent upon, the maturing of sex. A point here which is apt to be overlooked is the wide range of ages at which sex maturity arrives. For example, among girls in the United States, one quarter begin menstruation before the age of 12½, one quarter do not begin until after 14½[3]. While there does not seem to be a complete correlation between puberty and the mental stages, the very close connexion is enough to caution us against treating a given set of children of twelve or fourteen or sixteen years of age as essentially at the same stage of development.

Further evidence in support of this is found in the great variations in the age at which various characteristics appear. Thus in women moods of intense dejection began so early as twelve, in others not until nineteen or twenty years of age; a keen interest in the opposite sex began in some so early as eight, in others not until twenty; strong aversion from the opposite sex varies from eight to sixteen or never. Among the men an expectation of future greatness appeared at varying ages from eight to eighteen, or never.

The confidential essays revealed that many adolescents imagine their strange moods and impulses to be unique, which creates a feeling of intense loneliness.

The main sources of mental trouble seemed to the youths to be intense self-consciousness (accentuated if there was excessive size or extreme awkwardness), distress at social evils which seemed insoluble (unless the individual could have a free hand to deal with them), unhappy relations with parents, struggles with doubt about religion, sometimes disgust or fear at the first experience of sex emotions, or, in the case of girls, of premature advances by boys or men. There were also comments which confirm the view that the adolescent's wish to be independent of his parents' support and to feel himself a 'man' and enjoy greater freedom is a main cause for wishing to become a wage-earner at fourteen or as soon as possible.

One thing is clearly demonstrated by some of the essays, namely, that some of the intense feelings of inferiority during adolescence were consistent with remarkable strength or ability clearly demonstrated a few years later, even in those very things in which weakness had been felt. Thus several students who experienced intense feelings of inferiority and lack of confidence did brilliantly at the university and took a prominent part in the university life.

Another fact which emerges clearly is that some of the girls who had most intense feelings of affection for older girls or mistresses—real 'crushes'—turned out to be among the finest in character and ability at university stage. Some of these girls had been caused great unrest—acting like fond doting lovers—kissing the book lent to them by a beloved mistress, walking up and down the road past the house where the loved one lived, and so on.

In another inquiry I made in which students who had been at co-educational schools were compared with those at boys' or girls' schools, such homosexual attractions were far less frequent in the co-educational schools, and students from these schools were almost unanimously in favour of them.

Should we Discuss Adolescence with Adolescents?

A practical problem arises as to how far we could help the adolescent by letting him know that the great variations of mood, of extreme elation and dejection, or the contemplating of suicide, are often passing phases of the adolescent life. Such talks have indeed been suggested by some important bodies dealing with the training of young people. It would seem helpful to inform an adolescent that he is likely to be subject to extreme moods and, in particular, that he is not alone in the unhappy inclinations to run away from home or even to commit suicide. My own reports show clearly that many

* Based on a paper read before the annual general meeting of the British Psychological Society at Oxford during April 8–12.

adolescents feel a greater distress because they think their own inner struggles are unique. On the other hand, to speak to adolescents of the common intensification of religious interest, or of high ideals, as passing characteristics of this adolescent phase, or of the expectation of accomplishing great things in life as a common illusion, would seem clearly undesirable.

One matter at least could be spoken about, namely, the plain facts of sex development. It is clear that even in these days, in some cases, young people are allowed to experience the first signs of physical maturity without having been warned beforehand. In my own work of giving psychological analysis and treatment, I have known several cases in which great early distress due to ignorance about sex development set up neurotic conditions lasting for a considerable time, indeed until relief followed the discovery of their origin.

Delinquency during Adolescence

It is too commonly assumed that the main cause of juvenile delinquency is the removal of the child from school at too tender an age into the socially dangerous life of the young worker. But if we take into consideration the relative population for each age, it appears that thirteen is the age at which the percentage of juvenile delinquents is greatest[4]. When boys leave school and become wage-earners, delinquency actually decreases.

Reference to the figures will also show the surprisingly high numbers for delinquency among boys at the ages of twelve, eleven and even ten, in spite of the reluctance to bring delinquencies of younger children to official notice. Hence we cannot assume that the major cause of juvenile delinquency, among boys at least, is the removal from school and the mixing with older men, or the greater freedom due to employment, though for many, no doubt, it is a precipitating factor.

Among girls the frequency of (reported) delinquencies is, of course, very much lower than among boys (about one tenth) and the peak age is appreciably later in adolescence; this is no doubt due largely to the fact that such a considerable number of girl delinquencies are connected with sex.

In several inquiries it has been shown that juvenile delinquents are less often members of youth clubs than are their opposites in the control groups. Mr. W. L. Chinn found, among 1,000 juvenile delinquents in Birmingham, that only 31 per cent belonged to "recognized social organizations", while among the controls 61 per cent belonged to them[5]. (Chinn included children from the age of ten up to fifteen. The figures for children between fourteen and fifteen were: delinquents, 17 per cent; non-delinquents, 53 per cent.)

One important question, however, has to be borne in mind in considering such results. We do not know how far such differences are due to the fact that it is the 'good', socially well-adjusted boys who choose to become members of clubs, while those more inclined to delinquency are indifferent to such clubs; or, how far the difference is due to the good influence of the clubs upon the boys who do join them. The importance of selection seems undoubted. An examination of the results found by Carr-Saunders and his colleagues in the recent inquiry[6] confirms this view. They first of all eliminated from their consideration the 'abnormal' homes ('broken' homes or homes where there was bad discipline, or undue friction between the parents, or where one of the parents was unemployed or in bad health, or failed to reveal regular and exemplary habits). Taking only the 'normal' homes, they found the following figures:

REGULAR CLUB MEMBERSHIP

London		
Delinquents	(273 in number)	29 per cent
Controls	(550 in number)	35 per cent
Provincial cities		
Delinquents	(264 in number)	28 per cent
Controls	(539 in number)	30 per cent

In other words, where the homes were fairly satisfactory, regular club membership made very little difference as to delinquency.

This leads us, however, to ask another question. What would the figures be if these investigators had found the figures for *abnormal* homes? It is precisely among children from homes with bad influence that we should expect clubs to be most valuable. It would also be of great interest to find how the proportion of adolescents joining some club was affected by their coming from 'normal' or 'abnormal' homes. The same principle of selection applies to the figures for attendance at a church, when there was only a difference of 10 per cent between delinquents and controls. The figures for *attendance at evening schools* show still greater difference—only 7 per cent for the delinquents, nearly 33 per cent for the controls. Again we cannot of course assume that the evening schools had much direct influence on the tendency to delinquency or that compulsory attendance at evening schools would reduce delinquency. The main reason for the difference is again probably that the more serious, ambitious, or obedient pupils would attend evening schools, though no doubt occupation on some evenings would lessen the temptation to commit petty offences.

As to *home discipline*, there was a decided difference between the delinquents and the controls. In less than 60 per cent of the delinquents' homes was the disciplinary attitude satisfactory, whereas the figure for the controls was nearly 90 per cent. We may recall that Burt found that bad discipline in the home gave the highest correlation with delinquency, of all the factors he examined[7]. This confirms the view that the problem of delinquency and the training of youth cannot be solved by treating the youth himself in schools or clubs. It must also be tackled in the home itself, and some attempt made to educate parents in at least elementary principles of discipline. In interviewing (with school attendance officers) the parents of children who had been persistent absentees from school, I have been appalled at the stupidity of the attempts at discipline—or lack of them—to which parents confessed. I have no exact figures, but my general impression is that considerably more than half the difficulties were chiefly due to this: and if we include frequent illnesses in which there was also subsequent over-indulgence and lax discipline, nearly all cases would be covered.

One fact that is often overlooked is that many youths seem to survive the worst possible environment, while others succumb even in the most favourable environments; for example, more than 40 per cent of the delinquents come from normal homes where the atmosphere and discipline seemed satisfactory; while nearly 30 per cent of the non-delinquents come from homes without such normal

atmosphere. These facts lead the authors of "Young Offenders" to a conclusion similar to that I drew from investigations as to younger children[4], namely, that (i) there are some children who will develop sound characters in almost any type of environment; (ii) there are some who will go astray even in the best types so far as we can discover it; and (iii) there is a large intermediate section whose development will be profoundly affected by their environment.

The Youth Movement and Club Membership

The recent registration of youths, and the recommendations given to them to join some youth organization, should provide valuable material for the study of youth training, particularly if careful follow-up studies are made as to what happens to those who are not already members of some 'approved' organization. In Birmingham a report made to the Education Committee in September 1942 revealed that some 47 per cent of the boys aged sixteen and seventeen were not undertaking any 'approved activity' (which included junior service organizations) and were not receiving any systematic education. As to girls, it was found that as many as 73 per cent were not engaged in any approved activity. It should be noticed that the proportion of girls without 'approved activities' was actually greater at seventeen years than at sixteen, the figures for girls of the latter being 69 per cent and those of the former 77 per cent.

All young persons who were not attached to some organization were urged to join one and given an introduction to one of their own choosing. Only 18 per cent of the boys and 29 per cent of the girls were unwilling or unable to achieve introductions to such organizations. The larger organizations were afterwards asked to give their reports of the result of these introductions.

Reports as to boys were received from the Cadets, A.T.C., Navy League, Boys' Brigades, Boy Scouts, and Boys' and Girls' Union. None of these obtained more than a few new members, and many of these disappeared in a few weeks. The same was found for girls in the G.T.C., J.A.C. and Boys' and Girls' Union, but the Y.W.C.A. retained a considerable number.

Reports suggested that the long hours many juveniles were working, the need for help from the girls in the homes, especially where the mothers were working in factories, and the objection of parents to young people being out after 'blackout', all militate against the joining of organizations[5].

Even if the statistical evidence is not conclusive as to the value of club membership, few would doubt, on the mere basis of the general psychology of adolescence, that it is desirable to expand the provision for healthful and cultural leisure pursuits and also of opportunities for useful service.

The question of compulsory membership of youth organizations is a difficult one. It is agreed, of course, that education must be compulsory even if the youth himself would at the time prefer to do without it. If we accept this principle, then, so far as the Youth Movement includes 'educational' items, compulsion might seem to be justified by the same principle, at least up to corresponding ages, for those not continuing in full-time or part-time education. Another complication is the enormous variety of clubs and organizations, some of which can provide educational facilities, while others can only cater for recreation.

The whole matter is complicated by the question of continuation school education. If this were so organized as to provide essential education, youth organizations need only cater for additional interests and supplementary courses and recreations.

As to recreative pursuits, many hold that the whole atmosphere of the Youth Clubs would be spoilt if any element of compulsion were introduced, and indeed even compulsory educational courses might tend to create the unpopular atmosphere of a 'school'. No doubt the ideal is that the leisure activities should be so attractive as to need no further stimulus. The highly successful Sherbourne Youth Club in Birmingham, though catering for the roughest types of youths, has been able to impose compulsory attendance at some educational activity through the attractive power of its recreations, and still expand beyond capacity.

On the other hand, young people need at least some *information* as to what facilities are open to them. The Birmingham inquiry showed that often a youth ceased to attend some club after only one or two visits. But how many adults enjoy a first night alone in a holiday hotel, or what man is at ease the first day or two in a new club?

I suggest that some compulsion—or at least some compulsory choice of several alternatives—may be desirable, but only *for a time*, in order to give the youth the opportunity at least of judging whether this particular activity appeals to him, it being made clear to him that this is the only reason for compulsory attendance.

A further question arises as to whether there should be some compulsory form of service for the community. It is not the concern of a psychologist to discuss the rights and wrongs of State control, State propaganda, or the question as to how far the State should demand service of its young people. I merely wish to suggest here that we cannot assume, as is often done in educational discussions, that, because some service is made compulsory during adolescence, the youth will therefore become accustomed to this, and so become less selfish and give service voluntarily later on. This, I suggest, would only happen if in doing such compulsory service the youth discovered a new satisfaction and interest which he realized he would have missed otherwise. It is possible, indeed, that the compulsion to carry out 'good deeds' may have the opposite to the desired effects.

We should therefore look askance at such vague phrases as 'training youths to be co-operative' or 'unselfish', which are so often used in discussions on education, and we should demand much more specific statements as to *how* such 'training' is to be made permanently effective.

Finally, so far as service is appealed for, among our young people, it should surely be based on the ground that their help is needed and useful, and not that it is good for them. Indeed, it is only service given on such a basis that is in fact likely to be 'good for their soul', for it is that which will appeal to them most.

[1] See Prof. Wheeler's book "Youth" and her article in the *British Journal of Educational Psychology*, 1 (1931).
[2] A detailed account of the results and fuller quotations from the confidential essays are given in my article in the *British Journal of Educational Psychology*, 13 (June, 1943).
[3] Hollingworth, Leta S., "The Psychology of the Adolescent", p. 23.
[4] See figures quoted in "Young Offenders", p. 164 and also pp. 120-21.
[5] *Brit. J. Educ. Psych.*, 8 (1938).
[6] *Brit. J. Educ. Psych.*, 8, 88-89 (1938).
[7] See "The Young Delinquent".
[8] "The Difficult Child and the Problem of Discipline", p. 24 (Methuen).
[9] Fuller details of these reports and further discussion of results are included in my article in the *British Journal of Educational Psychology*, 13 (June, 1943).

TEN YEARS OF GROWING EXCISED TOMATO ROOTS

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MARCH 1, 1943, marked the decennial anniversary of the starting of the first uninterrupted cultures of excised plant organs[28]. The root tip from which was derived the standard clone now used in all experimental studies on excised roots carried out in this laboratory was severed from its seedling parent on March 1, 1933. This root is still growing. From it have been made some 80,000 experimental cultures. In addition to these cultures for which increment data are available, large stocks have been maintained on which detailed records were not kept. The total measured increments represent many kilometres of growth; the theoretical increments[29] amount to staggering figures (*ca.* 10^{2000} kilometres). It seems appropriate at this time to review briefly the history and behaviour of this clone.

Aseptic seeds of Bonny Best tomato were sown on sterile filter paper late in February 1933. When, on March 1, the seedling roots had attained a length of a centimetre or more, twenty-five of them were excised and each one placed in a separate flask. The nutrient[24] was, as was soon discovered, not a very satisfactory one. Only one of the 25 roots grew. This was transferred on March 13 to fresh nutrient of a somewhat different and more satisfactory formula[26]. From this root, during an initial period of ten passages averaging 13 days per passage (127 days), a clone of 100 cultures was built up. This number was maintained through 42 subsequent passages of 7 days duration each (294 days), during which time each culture was measured daily. At the end of the fifty-second passage (421 days) the number of cultures in the measured stock was reduced to 25 and measurements were recorded thereafter only at the beginning and end of each weekly passage. Measurements of initial length, final length, number of branches, and length of longest branch together with notes on general behaviour were recorded for each culture.

Transplants were made wherever possible by severing a piece about 15 mm. long from the apex of the culture[24]. Where, as occasionally happened, a culture became contaminated or the apex ceased to grow normally, this procedure, of course, became impossible. Such cultures were replaced where feasible by using the tip of a branch root which had already acquired its own dominance equal to that of the apex and was thus capable of equally rapid initial growth. This state is usually attained in tomato roots when the branch has reached a length of about 20 mm.[24]. When such branches were not available, fragments of the main root carrying one or more growing points which had not yet acquired this individual dominance were used as explants. Records were kept in such a way as to distinguish between these three categories: primary apices, secondary but dominant apices, and secondaries lacking established dominance, since cultures of the third category, in particular, usually showed a considerable lag in increment until some one branch acquired its own dominance.

A number of points of interest appear in the growth record for the ten years (512 passages). It has already been noted[43] that the average growth-rates, in spite of their wide and apparently random week-to-week variation, nevertheless approximate a sine curve when grouped in 26-week blocks beginning at the vernal and autumnal equinoxes. The average increment-rate for the entire ten years was $6{\cdot}73 \pm 0{\cdot}15$ mm./cult./day. If we ignore the initial 20 passages which preceded the establishment of a standard procedure (average increment $3{\cdot}05 \pm 0{\cdot}42$ mm.) and begin with the autumnal equinox of 1933 (passage 21), there was no significant change in *average* increment-rate until the vernal equinox of 1938 (passage 254), that is, during the first $4\frac{1}{2}$ years. Throughout this time the nutrient consisted of a modified Uspenski salt solution, sucrose, and yeast extract, and the original standard procedure was maintained. The

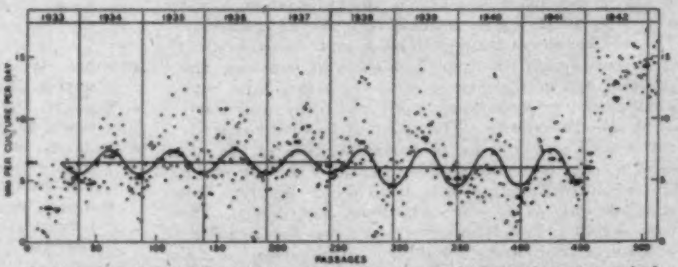

Chart showing the week-by-week increment rates of a single clone of growing excised tomato root tips over a period of ten years (523 passages). Each dot represents the average increment of 25 cultures during a single week (see text for exceptions in the first 52 passages). The average for each 26-week inter-equinoctial period is shown by a thick horizontal dash. The sine curves are drawn with nodes at the equinoctial points, the maxima and minima being drawn to correspond with the mean summer–winter fluctuations for the particular long-term periods represented by each distinct base line.

average growth-rate for this period was $6{\cdot}47 \pm 0{\cdot}15$ mm./cult./day. The average summer rate was $7{\cdot}47 \pm 0{\cdot}27$ mm., while the winter average was $5{\cdot}60 \pm 0{\cdot}15$ mm./cult./day. The difference between these, $2{\cdot}22 \pm 0{\cdot}24$, is 33 per cent of the average value—hence highly significant.

The interval between the vernal equinox of 1938 and a time shortly after the autumnal equinox of 1941 (passage 447) represents a second important culture period ($3\frac{1}{2}$ years). During this period a number of changes in procedure were tested. Chief among these was the substitution of glycine[27], thiamin[40,42,52], and certain accessory salts[44] for the yeast extract employed throughout the earlier period. These irregularities and changes in procedure resulted in a slight decrease in mean increment-rate and a concomitant increase in range of variability to $6{\cdot}06 \pm 0{\cdot}22$ mm./cult./day. The decrease is statistically of doubtful significance, the difference being $-0{\cdot}47 \pm 0{\cdot}24$ mm. With passage 448 a new and improved inorganic nutrient was introduced[22]. This resulted in an apparent improvement in growth ($4{\cdot}9 \pm 0{\cdot}3$ to $6{\cdot}1 \pm 0{\cdot}9$ mm. in the consecutive 13-week periods representing equivalent segments of a single inter-equinoctial period), but the period tested was too short for the difference to be statistically significant (difference $= +1{\cdot}29 \pm 0{\cdot}9$ mm.). With the vernal equinox of 1942 a more important change was made. At this point pyridoxine and niacin were introduced[21] into the nutrient according to the recommendations

of Robbins and Schmidt[24–26] and Bonner[28]. This resulted in a sharp increase for the following year to a level of 12·6 ± 0·8 mm. The increase here, over the previous mean rate, was + 6·1 ± 0·8, hence highly significant. This last nutrient has been used for too short a time (54 passages) to establish a new seasonal cycle. The results so far suggest, however, that the seasonal cycle may become much less pronounced in this nutrient. The impression given is that the great number of nutrient materials available and the more nearly optimal complex of environmental conditions provide a buffer against the injurious effects of certain variables, especially temperature fluctuations[19]. This is presumably comparable to the means by which field conditions permit plants to survive and prosper under a range of variables to which they would succumb in the laboratory.

The random week-to-week fluctuations observed throughout the ten years are, for the most part, not capable of interpretation. The causes of a few are, however, known. The sudden drop in the 179th to 181st passages is such a one. This almost resulted in loss of the entire clone, for in the 181st passage, out of the 25 cultures only a single one, No. 12, survived. The entire clone was recovered and re-established from this single root tip, and even in this case the primary tip and all six of the secondary tips were killed, the meristem being recovered from nine newly established tertiaries. The cause of this near-tragedy was traced to a split in the condenser tube of the still used in preparing distilled water, allowing tap water to pass into the supposedly pure water supply. This was not city water but came from deep wells. The toxic agent is not definitely known but was probably a trace of lubricating oil shown to be present in the laboratory water supply in considerable quantity. When this condition was corrected the cultures recovered rapidly, and by the 184th passage had been built up to full number (25) and a normal increment rate (5·3 mm. as against the idealized average for that time of year of *ca.* 6·6 mm.). The sudden drop in the 228th passage was correlated with and probably the result of a very sharp drop in room temperature[19], such as sometimes occurs in mid-September. The windows of the laboratory had been left open following a very hot day, and a sudden fall in outdoor temperature was paralleled by that indoors, resulting in thorough chilling and excessive condensation on the walls of the flasks. Recovery from this was as abrupt as its incidence. The low general level between passages 279 and 287 coincided with a period of illness during which the clone was maintained by a relatively inexperienced assistant. The low level between passages 372 and 409 occurred in a period when the concentration of iron had been reduced as a result of experiments later shown to have been misinterpreted[28]. The sudden fall in passage 425 resulted from the accidental omission of iron from one batch of nutrient. Other fluctuations are, however, unexplained.

The clone is still in excellent condition and shows every evidence of potential immortality. Cultures of this stock have been sent to the University of Missouri, the California Institute of Technology, New York University and Connecticut College, where they have been maintained through various periods, for special studies and for comparison with other clones of tomato roots.

Since this note is chiefly historical in import, I have appended a chronological bibliography of all papers dealing with the cultivation of excised root tips that have come to my attention, which gives, better than could any but a very extended discussion, a panoramic view of the development of this branch of plant tissue culture. I have purposely omitted references dealing exclusively with the cultivation of other tissues or organs, except for a few of the very early background papers, since these represent a separate though closely related field.

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THE ROTHAMSTED CENTENARY

IN spite of the difficulties arising out of the War, an impressive gathering assembled at Rothamsted on July 21 to take part in the commemoration of its hundred years of uninterrupted work in agricultural science. There have been several similar occasions in the history of the Station, when the leading figures in the agricultural world have been glad to testify to the value of its activities. The first was in 1855, when a new laboratory building was formally handed over to Lawes and Gilbert as a testimonial from British farmers in recognition of twelve years pioneering work. The second was the jubilee of the Rothamsted Experiments, celebrated in 1893, when the experiments, having completed fifty years, had left their mark not only on home farming but also on settled agriculture over a much wider area. Now, after the passage of a further fifty years, we were witnessing another ceremony—not, of course, on the international scale which would have been appropriate in normal times, but none the less a very outstanding demonstration of the high regard in which the past and present work of the Station is held in scientific and agricultural circles. Lord Radnor, chairman of the Lawes Agricultural Trust, presided, and the Right Hon. R. S. Hudson, Minister of Agriculture, received a special welcome from the three hundred guests representing various scientific societies and all sides of the agricultural and allied industries. Representatives, diplomatic, scientific and agricultural, from twenty-eight countries were present.

Welcoming the guests, Lord Radnor recalled some of the main facts in the history and achievement of the Station, and said that the completion of the first century of work coincided with the coming retirement of Sir John Russell and the appointment of Dr. W. G. Ogg, of the Macaulay Institute of Soil Research, Aberdeen, as director. In his speech, the Minister of Agriculture pointed out how the proper use of fertilizers so firmly based on Rothamsted work from its earliest days is now more than ever essential in the food production campaign. He gave as an example the key position of superphosphate—the first great practical outcome of Lawes' experiments—

in the present need to establish new grass on worn-out plough land, and bring poor pasture into productive arable cropping. Fortunately, owing to the Allied victories in North Africa, the supply of this essential requirement is improving, for cargoes of phosphate rock are now coming in. He was pleased to find that, thanks to the practical example presented by land managed by war agricultural committees, farmers are more ready to adopt new methods than they have ever been. In conclusion, the Minister congratulated Sir John Russell on his well-earned retirement and expressed his hope that Rothamsted would long continue its work in fundamental agricultural research.

Sir John Russell then gave his director's address. Remarking that it was the last time that he would address an annual gathering in his present capacity, much of his speech dealt with the way in which Rothamsted fits into the general pattern of agricultural research and education in Great Britain. The function of Rothamsted, he said, is the development of a sound, trustworthy science of plant growth for the use of experts, teachers and farmers. Once the scientific principles are definitely established, the local organization can proceed to apply them to the solution of immediate practical problems—a vitally important task in modern agriculture, the success of which is limited by the amount and value of the scientific knowledge available.

The remainder of the programme was designed to give a view of the extensive and excellent modern equipment of the laboratories and farm against the background of the early history and continuity of the famous experiments. The visitors were conducted through the laboratories, where each department had arranged exhibits to illustrate important results, and special apparatus such as the electron microscope and polarograph. To amplify the necessarily short demonstrations, a comprehensive summary of the work of every department was distributed in booklet form. A recent account of the botanical investigations appeared in NATURE of July 24, p. 91. In the main hall was a collection of prints and original letters which recalled the earliest days of the Station, when the experiments were conducted in the old barn laboratory and the Lawes-Leibig controversy was in its bitterest phase.

The tour round the farm was made over a course that could be followed by tractor-drawn trailers on which the visitors were accommodated. Owing to the large company, loud speakers were called into service for the first time. Broadbalk, carrying its hundredth successive wheat crop, was the central attraction of the tour, and this year the field had risen to the occasion and produced a crop well above average. Thanks to the trailers, many visitors obtained a better view of the modern field work of the Station than ever before, for they saw many factorial plot arrangements testing problems of immediate practical importance: the substitution of potash by salt for sugar beet and barley, the utilization of sewage sludges and compost, manurial trials on flax, to mention only a few. Long-term work involving the study of slow changes in the soil was represented by rotation experiments on the utilization of straw. One of the most interesting exhibits in the farm buildings was the special equipment used at Rothamsted for laying out, harvesting, and threshing the field experiments.

The impression given by this visit to Rothamsted on its hundredth birthday was not one of age, but rather of abounding vitality. H. V. GARNER.

NEWS and VIEWS

Scientific Research in Great Britain

IN a debate on scientific research in the House of Lords on July 15, Viscount Samuel urged the need for further expansion of scientific research, particularly in relation to the utilization of coal. After stressing the need for research in all branches of science relating to food and agriculture, in nutrition, in building, in town and country planning and in the social sciences, he referred to the emphasis laid on research in the report of the Coal Industry Commission in 1925-26, and asked for an indication as to the Government's future plans for the expansion of research into all branches of the fuel and power industries. Lord Samuel mentioned the importance of giving the scientific worker himself proper status and the opportunity of advancement to administrative appointments when he possesses administrative ability, and asked whether there is any plan for allocating the work of scientific research between the three main agencies now engaged in it, namely, the State, the universities and the industries. Secondly, he asked whether anything could be said at this stage with regard to the conditions of employment of those engaged in scientific research, and whether there is any possibility of a combined scheme for pensions which would enable accrued pension rights to be transferred if a worker passes from one institution to another. Next, he inquired whether there is any prospect of a State scientific service being established parallel to the Civil Service and under the general direction of a commission like the Civil Service Commission but containing professional men of science. Finally, he again raised the question of the advisability, after the War, of appointing scientific attachés to the principal British Embassies abroad.

In supporting Lord Samuel's motion, the Earl of Listowel suggested that the Government programme to guarantee our industrial future should promote a gradual but steady increase in existing facilities for scientific research into the post-war problems of industry, an expansion including the research workers and the scientific equipment of universities, private firms and Government institutions. Secondly, to prevent overlapping and to secure the right priorities, these extended facilities should be co-ordinated and developed according to a national plan for scientific research. Lastly, it should arrange for consultation and co-operation with the Dominions and Colonies and with others of the United Nations. Lord McGowan welcomed the Government grant of £5,000,000 for research on coal, but considers that that sum will be found quite inadequate. Speaking of science in relation to industry generally, he urged that if we wish to hold and increase our export trade, there must be intensive research to find new processes and new products. Research on existing processes is day-to-day work, never ending, and accumulated knowledge creates of its own accord considerable industrial

advances. Fundamental research is more a function of the universities. There is still much to be done in extending scientific academic facilities, and while this is a great opportunity for Government assistance, industry has also a big part to play, and he pleaded that industry should assist by financial grants. Lord Brabazon warmly applauded the work of scientific men in Great Britain. He also referred to the need for scientific men who could bring together and correlate the knowledge of different branches of science.

The debate was resumed on July 20, and Lord Cherwell, replying for the Government, reviewed the question of Government intervention in research. Admitting that in the last decade emphasis had tended rather away from fundamental research to the industrial side, he said that the whole distribution of effort is now being reviewed, and he hoped that it would be agreed to extend considerably Government support of pure scientific research. It is extremely difficult to make people realize the importance of fundamental scientific research and its value to the community, but even from the economic point of view we cannot overrate the importance of fostering such research. While that must be in large measure the responsibility of the Government and carried out at the universities, the Government also wishes to encourage industry to spend money on pure research. It is the policy and intention of the Government to increase the assistance given to pure research, but any similar developments in industry would be welcomed. Lord Cherwell welcomed a reference made to training in science, and said that the Board of Education is conscious much remains to be done in this field and is anxious to develop it as part of its policy for post-war reconstruction. Frankly admitting that the Civil Service has not hitherto shown due regard for the contribution which men of science are making to the nation's welfare, he stated that an investigation has been in progress to make sure that the conditions of service, pay and prospects of Government scientific employees compare favourably with those on the administrative side so that, among other things, interchange might be made easier, and he hoped that a definite announcement that these reforms are to be put into effect would be made before long. In welcoming this statement, Lord Winster expressed the view that when the history of Mr. Churchill's administration came to be written, it would contain a chapter on what has been done for the encouragement of science in Government Departments that would reflect the greatest credit on the Prime Minister.

A Pioneer of the Rubber Industry

ON July 25 occurred the centenary of the death of the Scottish chemist Charles Macintosh, whose name is now a household word through his discovery of how to render cloth waterproof by cementing two layers of fabric together with a solution of rubber in naphtha. His patent for the process was taken out in June 1823, and at the works he established at Manchester the first "Waterproof Double Textures" were manufactured. His work was contemporary with that of Thomas Hancock (1786–1865), who for many years was his collaborator and partner. Together they firmly established the rubber industry in Great Britain. To Hancock also belongs the credit for the introduction of the 'vulcanization' of rubber, but he was led to the discovery of this process through experiments made after receiving a piece of rubber which had been subject to the process of 'solarization' by Charles Goodyear (1800–60) in America.

Macintosh was the son of a practical chemist and was born in Glasgow on December 29, 1766. As a youth he attended the lectures of Black at Edinburgh, and at the age of twenty began manufacturing sal ammoniac. He started the first alum works in Scotland, and for a time was associated with Charles Tennant of the St. Rollox works in Glasgow. He travelled a good deal on the Continent and was known to most of the principal chemists of his day. Among his friends was James Beaumont Neilson, F.R.S., the first engineer of the Glasgow gas works and the inventor of the 'hot blast'. In 1819 Macintosh engaged to take all the tar and ammoniacal liquor—then waste products—from the gas works, and it was in his treatment of the tar that he obtained naphtha, which he found could be used to make waterproof varnishes.

Royal Society of Edinburgh: Robert Cormack Bequest

THE Royal Society of Edinburgh has been made the residuary legatee of the estate of Mr. Robert Cormack, of Edinburgh, who died on August 13, 1942. The Society is directed to administer this bequest for the purpose of promoting astronomical knowledge and research in Scotland, so far as practicable, on the lines of a memorandum prepared in 1931 by the late Prof. R. A. Sampson, Astronomer Royal for Scotland. The Council, on behalf of the Royal Society of Edinburgh, has accepted the bequest, which represents an amount somewhat over £30,000; and, after careful consideration, has approved a general scheme for the administration of the Trust, which will include: (*a*) research fellowships to be awarded on suitable conditions to students engaged on research in Scottish observatories and to students or graduates of Scottish universities desirous of engaging in research in foreign or Dominion observatories; (*b*) the publication of the results of such research; (*c*) lectures to be delivered in suitable centres by eminent foreign or Dominion astronomers; (*d*) grants in aid of the purchase of special equipment for use in Scottish universities or observatories in research work; (*e*) lectures and demonstrations of a more popular character under the auspices of the Scottish educational institutions. A large part of this scheme will not be developed during the War.

Fleas of North America

UNDER the foregoing title, H. E. Ewing and Irvine Fox have written a taxonomic revision of the North American Siphonaptera. Such diseases as bubonic plague and a mild form of typhus are carried to man by the agency of these insects, which also play an important part as pests of livestock, etc. The matter of correctly identifying fleas assumes, therefore, considerable importance, and the present work will aid those engaged in such procedure. Full descriptions are given of the genera and higher groups, and are accompanied, for the most part, by illustrations of diagnostic characters. Formal descriptions of species and subspecies are avoided and, instead, remarks on characteristic features are given. The paper is issued as Miscellaneous Publication No. 500 of the U.S. Department of Agriculture

1943), and in it are listed 61 genera and 209 species of fleas from North America and the West Indies. In discussing the relationships of the Siphonaptera the authors take the view that they are derived along with the Diptera from a common ancestral stock. They regard fleas as being more ancient and more primitive than Diptera and classify them into six families. Owing to synonymic changes several of the names thus used will be unfamiliar to non-specialists. At the end of the paper is a very complete bibliography which takes into account the literature on these insects up to October 1940. A careful revisional paper of this kind is of wider interest than to North American workers only, and it is commended to the attention of students in Britain also.

Rubber-yielding Dandelions in Sweden

ACCORDING to the June issue of the *Anglo-Swedish Review* the scarcity of rubber in Sweden forced that country to evolve substitute products. The experimental production of synthetic rubber has been going on for some time, and its manufacture on a commercial scale has been commenced by a number of companies. Side-by-side with the work attempts are being made to cultivate rubber-yielding dandelions of the Russian type (*Taraxacum kok-saghyz*). Cultivation on a small scale started last year and this year it will be possible to extend somewhat the sown area by means of seed obtained from these cultivations. It is estimated that by the end of 1944 Sweden will have at its disposal about 300 kilograms of seed and a crop of about 27,000 kilograms of one-year old root and 38,000 kilograms of two-year old root in addition to a sown area of 230 hectares. The rubber content in the one-year old root is estimated at 2 per cent and in the two-year old root at 3 per cent. The rubber obtainable from this crop will be very insignificant, but enough for further experiments to ascertain the quality of this rubber and its susceptibility for various purposes.

Future of Technical Colleges

Messrs. R. M. Barrer and J. P. Andrews have written in connexion with their letter in NATURE of July 17, p. 80, on this subject. The phrase "relieve the Technical Colleges of the necessity of preparing students for External University Degree" appearing in quotation marks implies that it was quoted from the report of the Board of the Institute of Physics. This is not the case, so quotation marks should not have been used.

The Night Sky in August

NEW moon occurs on August 1d. 04h. 06m. U.T. and full moon on August 15d. 19h. 34m. New moon occurs again on August 30d. 19h. 59m. The following conjunctions with the moon take place: August 2d. 15h., Mercury 0·5° N.; August 4d. 08h., Venus 7° S.; August 22d. 16h., Mars 4° N.; August 24d. 18h., Saturn 3° N.; August 28d. 21h., Jupiter 0·9° N. The following occultations of stars brighter than magnitude 6 occur: August 12d. 21h. 38·9m., 121 B. Sgr (*D*); August 20d. 23h. 09·4m., ξ^2 Cet (*R*); August 23d. 03h. 02·0m., γ Tau (*D*); August 23d. 04h. 09·7m., γ Tau (*R*); August 23d. 12h. 36·8m., ι Tau (*D*). The times are given for Greenwich, and *D* and *R* refer to disappearance and reappearance respectively. Mercury is an evening star, reaching its greatest eastern elongation on August 29, on which day it sets at 19h. 23m. At the beginning of the month it sets about 20 minutes after sunset. Venus is stationary on August 13 and sets at 19h. 50m. on that day. At the beginning and end of the month the planet sets at 20h. 45m. and 18h. 10m. respectively and is visible as an evening star during the first part of August. Mars moves from the constellation of Aries to Taurus early in August. The planet can be seen as a morning star and rises at 23h. and 21h. 5Cm. at the beginning and end of the month respectively. Jupiter is too close to the sun to be observed in the early part of the month. At the end of the month the planet rises at 3h. and sets nearly an hour before sunset. Saturn, in the constellation of Taurus, is a morning star and rises at 1h. and 23h. at the beginning and end of the month respectively. Times are given approximately for the latitude of Greenwich. In addition to the phenomena mentioned above, the following take place: August 4d. 17h., Mercury in conjunction with Regulus, Mercury 0·8° N.; August 17d. 07h., Mercury in conjunction with Venus, Mercury 6·1° N. The Perseid meteors will attain their maximum on August 10–12, but moonlight will interfere with the observations until midnight.

Eclipses. There will be an annular eclipse of the sun on August 1, invisible at Greenwich. It will be visible as a partial eclipse in Australia and its magnitude will be 0·69 at Melbourne, where it will commence and end at 4h. 02m. and 6h. 54m. respectively. A partial eclipse of the moon will take place on August 15 and will be partly visible at Greenwich. The beginning will be visible generally in the western part of the Pacific Ocean, Antarctica, Australia, New Zealand, the Indian Ocean, Asia, south-eastern Europe and Africa, except the north-eastern part. The circumstances of the eclipse are given below:

Moon enters penumbra	Aug. 15d.	16h.	58·0m.
,, ,, umbra	15	17	58·5
Middle of Eclipse	15	19	28·4
Moon leaves umbra	15	20	58·1
,, ,, penumbra	15	21	58·3

Announcements

THE University of Oxford has conferred the honorary degree of D.Litt. on Prof. A. L. Bowley, acting director of the University of Oxford Institute of Statistics.

THE University of Leeds is to confer the following honorary degrees: *LL.D.*, Prof. H. S. Raper, Brackenbury professor of physiology in the University of Manchester; *D.Sc.*, Mr. E. V. Evans, chairman of the Gas Research Board.

AT the recent annual meeting of the Royal Society of New South Wales, it was announced that the Council has awarded the Clarke Memorial Medal for 1942 to Dr. W. L. Waterhouse of the University of Sydney in recognition of outstanding contributions in the sphere of natural science, particularly in plant pathology.

AT the annual general meeting of the Institute of Physics held on July 22, the following were elected to take office on October 1: *President*, Sir Frank Smith; *Vice-Presidents*, Mr. E. R. Davies, Dr. W. Makower and Mr. T. Smith; *Honorary Treasurer*, Major C. E. S. Phillips; *Honorary Secretary*, Prof. J. A. Crowther; *Ordinary Members of the Board*, Prof. J. D. Cockcroft, Mr. D. C. Gall, Dr. H. Lowery, Mr. D. A. Oliver, Mr. A. J. Philpot, and Mr. R. S. Whipple.

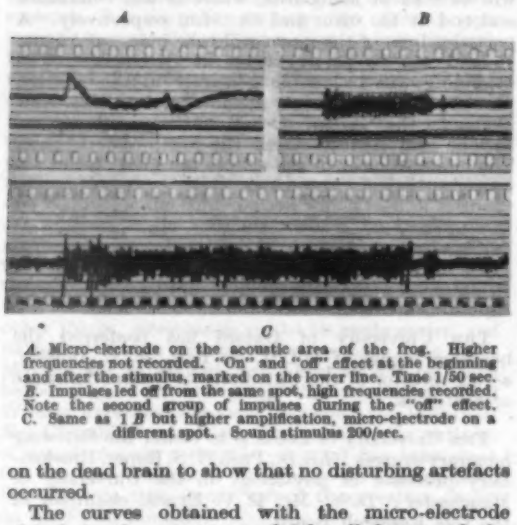
LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Electrical Responses from the Primary Acoustic Centre of the Frog

IT has been shown that sound stimuli elicit electrical potential changes in the central auditory pathways in the cat[1,2]. We have studied these responses in the frog, using micro-electrodes, which permit of a more detailed picture in respect of at least some of the electrical phenomena.

The roofs of the skulls of isolated heads of *Rana temporaria* were removed and the preparations placed on cotton wool soaked in Ringer's solution. Potential changes were led off from the acoustic area in the dorso-latero-cranial part of the bulb by means of an isolated tungsten micro-electrode and an Ag-AgCl-electrode placed on the cotton wool bed, and led to a capacity-coupled 4-stage amplifier operating a cathode ray oscillograph, from which the deflexions were photographically recorded. Controls were made



A. Micro-electrode on the acoustic area of the frog. Higher frequencies not recorded. "On" and "off" effect at the beginning and after the stimulus, marked on the lower line. Time 1/50 sec. *B*. Impulses led off from the same spot, high frequencies recorded. Note the second group of impulses during the "off" effect. C. Same as 1 *B* but higher amplification, micro-electrode on a different spot. Sound stimulus 200/sec.

on the dead brain to show that no disturbing artefacts occurred.

The curves obtained with the micro-electrode placed in the most superficial cell layers of the acoustic area revealed a certain amount of spontaneous activity (Fig. *C*), confirming previous findings[3]. The discharge was of a low voltage (5–15 μV.) but clearly distinguishable from the noise-level. Sound stimuli, produced by a loud-speaker, fed from a neon lamp oscillatory device, elicited typical changes in the picture, though the area from which these responses could be obtained was rather small. With the use of a frequency filter and a time constant of the amplifier of the order of two seconds it was possible to record slow waves at the beginning and immediately after the conclusion of the stimulus, appearing as 'on' and 'off' effects. Effects of this kind are shown in Fig. *A*. The latent period for the appearance of the first spike-like deflexion was 20–40 m.sec. The 'on' and 'off' effects were always of opposite signs and, in our arrangement, had an amplitude of up to 100 μV. When the amplifier was tuned for higher frequencies a sudden outburst of impulses in rapid succession occurred at the onset of the sound stimulus, and lasted slightly longer than the latter. During the 'off' effect a definite inhibition of the discharge could be observed. This was more distinctly borne out by curves recording the train of spikes when the amplifier was working with a short time constant, as illustrated in Fig. *C*. The spikes started after a latency period of 20–30 m.sec. corresponding to the appearance of the 'on' effect. The amplitude of the spikes remained practically unaltered during the stimulus, if this lasted less than 2 sec., but usually became gradually less during longer stimuli. As to the frequency of the spikes, it corresponded closely to the frequency of the sound stimulus, within the range studied in the preliminary experiments (200–500 cycles). A similar correspondence has been described previously for the acoustic nerve[1]. That the effect is not a microphonic one was shown by the latent period and by the 'off' effects described below. The 'spikes' shown in Fig. *C* do not seem to represent the activity of single fibres, since it has been found that the amplitude varies with the intensity of the stimulation. It therefore seems more probable that they are built up by the simultaneous activity of a group of fibres.

At the end of the stimulus the impulses continued for about 50 m.sec. at a diminishing amplitude. After this a short silent period ensued, followed by a short, but very distinct volley of spikes, lasting a few hundredths of a second and of about the same frequency as during the preceding discharge. After this volley the spontaneous activity was usually markedly reduced for some 50–100 m.sec. When slow waves only were recorded, as in Fig. *A*, a few waves occurred during the 'off' effect, which seem to correspond to the volley of spikes described above. The silent period and the secondary volley of spikes were usually well marked after short stimuli (about 1 sec.) but may be absent after stimuli of 10–30 m.sec. duration. There was no evident correlation between the duration of the stimulus and the amplitude of the 'off' wave. The latter, however, like the other effects described, is correlated with the intensity of the stimulus.

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Relation between Experiments on Isolated Muscle and Isolated Strips of Myosin

Astbury and Dickinson[1] have shown that isolated strips of myosin from unstriated muscle show thermal contraction below 40° C. It is interesting to note that living muscle also begins to show increased tone at this temperature[2,3]. The effect of alkalis is to increase the contraction of myosin; in actual muscle, tone is increased in alkaline solutions[4–7].

These observations are interesting in view of the relation between isolated, dead myosin and that of living muscle, and also because of their bearing on the nature of muscular contraction. A substance may act directly on the contractile mechanism of the muscle, or indirectly through the excitability system. If any agency affect myosin and muscle identically, then it acts on the contractile mechanism directly, though it may also affect the excitability mechanism. A rise in temperature will directly affect the contractile mechanism.

Contraction of myosin and of muscle under similar conditions suggests the possibility of muscular contractions without oxygen consumption. When unstriated muscle is immersed in solutions containing barium chloride, a reversible contraction occurs which persists when the muscle dies[4]. This contraction is not accompanied by an increase in oxygen consumption[5]. Barium chloride solutions do not harm the muscle, which may remain alive in such an environment for several hours. The persistence of the contraction after death of the muscle is noteworthy.

If the normal contraction of muscle be due to the contraction of myosin molecules, then the internal friction between molecules would increase when the muscle contracts[6] and the viscosity of muscle would thus increase. Gasser and Hill[6] found that the viscosity of striated muscle increases during contraction. Such increase in viscosity should then be abolished by stretching, which should undo the intramolecular transformation. In Mytilus muscle, stretching decreases viscosity, as shown by its effect on the rate of change of length[6,7,8]. It is generally considered that unstriated muscle, which is usually tonically contracted, is more viscous than striated muscle.

The question then arises as to why in one type of contraction there is an increase in oxygen consumption and not in the other. It might be suggested that, when accompanied by an increase in oxygen usage, contraction is maintained by an unstable metabolite, which, by combining with myosin, induces attraction between component parts. When unstriated muscle contracts without increase in oxygen consumption, distortion of the myosin molecule may cause attractive forces to come into play without any intervening agency.

When unstriated muscle is immersed in sucrose or glucose solution, it contracts, but its oxygen consumption decreases[4,9]. When the muscle is re-immersed in Ringer solution, it relaxes and its oxygen consumption increases. In this connexion it is interesting to note that the oxygen consumption of isolated unstriated muscle, which is usually found in a state of tonic contraction, is less than that of isolated striated muscle, which is usually relaxed.

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A Modification of the Gemmell Single Cyst Technique for the Potato Strain of the Eelworm *Heterodera schachtii* Schmidt

THERE is little doubt that the single cyst technique recently described by Gemmell[1] is a considerable advance on methods previously used in work with the potato strain of the eelworm *Heterodera schachtii*. As it is probable that the method will eventually be widely used, it was thought worth while to describe a simple modification of the method which, it is thought, possesses certain advantages over the original.

In the Gemmell technique, each cyst is kept in a single drop of potato root excretion on a cover-slip which rests on a glass ring standing in a Petri dish. The drops of excretion are prevented from evaporating by a sheet of moist filter paper lining the floor of the Petri dish, and half-inch diameter holes, on which the glass rings stand, are punched in the paper so that counts of the larvæ can be made by observation through the clear areas; when counts are made, the under surface of the cover-slip has to be wiped to remove condensed moisture, and the slip is then replaced on the glass ring. Each 12 cm. petri dish accommodates five cysts. Clearly, the examination of several hundred cysts involves considerable manipulation; the following method is much more economical of labour, and, incidentally, of glassware too.

Circles are 'stamped'-on a Petri dish by means of a half-inch diameter ring first dipped into melted 'Vaseline'; a single cyst and a drop of root excretion are added to each circle, as in the Gemmell technique, but the chamber is kept moist by filter paper adhering to the *lid* of the Petri dish. The advantages of this method are: (1) 25 cysts are easily accommodated in a single 12 cm. Petri dish and larval counts are therefore easier; (2) the problem of moisture condensation is eliminated.

Gemmell transfers each cyst to another cover-slip after each larval count; it is doubtful if this is really necessary, at least with the modified technique, for the larvæ can be removed with certainty with a bent pipette, and fresh root excretion added. The 'Vaseline' circles are easily made, and, in contact with root excretion, they retain their sharp outline for weeks. Paraffin wax can be used instead of 'Vaseline', but the latter is more easily used owing to its lower melting point.

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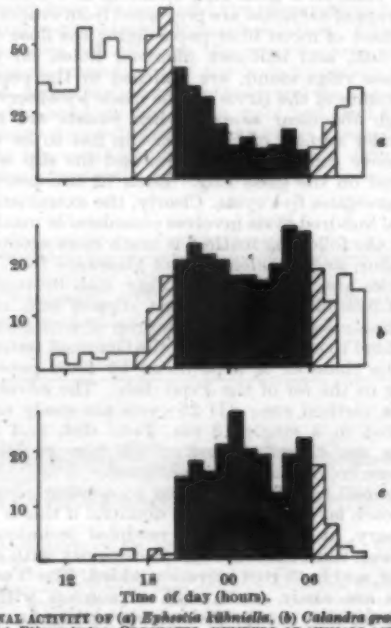
Diurnal Activity of Three Insect Pests of Stored Products

I WAS recently enabled, through the kindness of the mill staff, to carry out a series of observations over a 24-hour period in a certain flour mill. The mill contained bags of infested spaghetti which had been stacked up in preparation for fumigation. The stacking was done three days before the observations were made, and it was assumed that any disturbing effect of moving the bags during stacking had died down.

The animals dealt with were *Ephestia kühniella* Zell. larvæ, *Ptinus tectus* Boie. adults and *Calandra granaria* L. adults. The observations consisted of hourly counts of the numbers of animals active on the surface of a certain area of the spaghetti bags. An electric torch was used for observing the animals, and it was allowed to play on them for as short a time as possible, so as to minimize its disturbing effect. During the mill's working hours, 8 a.m.–5 p.m., electric lighting was on, which together with daylight coming in from open doors gave dim light. Some machinery was in action, causing a certain amount of vibration. Readings of temperature and relative humidity were made directly after each count. The temperature only varied from 11·5 to 12·5° C., while the humidity was between 70 and 80 per cent throughout.



DIURNAL ACTIVITY OF (*a*) *Ephestia kühniella*, (*b*) *Calandra granaria* AND (*c*) *Ptinus tectus*. ORDINATES, NUMBERS OF ANIMALS ACTIVE; ABSCISSÆ, TIME B.S.T. BLACK-OUT PERIOD IS SHOWN IN BLACK; PERIOD BETWEEN BLACK-OUT AND MILL WORKING HOURS IS SHADED.

The results are shown in the accompanying figure. Those for *Ptinus tectus* confirm in "the field" results obtained by Bentley *et al.*[1] in laboratory conditions. *Calandra granaria* shows a similar pattern of activity. In *Ephestia kühniella* the reverse pattern is shown, activity being greatest during the daytime. In Ptinus and Calandra activity and exposure are parallel; during the day-time when the animals are inactive they are hidden away in cracks, under bags, etc. The reverse is true for Ephestia larvæ; during the night, when activity is least, many animals are exposed. They lie motionless on the surface of the bags, and are easily visible. The largest number of caterpillars, counting both active and inactive, was seen exposed on the surface of the bags shortly after dusk.

From casual observations in various parts of the mill throughout the night it was clear that the following species are also more exposed during the night: *Tenebrio molitor* L. (larvæ), *Oryzæphilus surinamensis* L. (adults), *Ptinus tectus* Boie. (larvæ), *Ephestia kühniella* Zell. (adults), *Lyctocoris campestris* F. (adults and nymphs).

These observations confirm the impression generally held that insects in stored products are more obvious by night than by day. This is true not only for those which show greatest locomotory activity by night, but also for caterpillars of *Ephestia kühniella*.

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Tablet Absorption and Ghost Formation

THE formation of ghosts in compressed tablets of synthetic œstrogens during subcutaneous implantation has been previously described[1]. These structures are probably composed mainly of scleroprotein formed by a reaction between the synthetic œstrogen and soluble protein in the tissue fluid. The phenomenon has also been observed in tablets of œstrone, œstradiol and pregneninolone in the human[2] and in a tablet of testosterone propionate in a bull. It has since been found that ghosts are formed *in vitro* in hexœstrol tablets incubated in blood serum and plasma and in aqueous solutions of various proteins.

Further absorption studies with compressed tablets of pure hexœstrol, carried out primarily with the object of elucidating the role of ghost formation in tablet absorption, have led to the following conclusions.

Compressed hexœstrol tablets, of the type used, possess a labile fraction (that may or may not be located in the surface zone) which is quickly lost on subcutaneous implantation or incubation with blood plasma or with distilled water. The remaining portion is much less soluble. It was reported previously[3] that tablets re-implanted subcutaneously after a previous *in vivo* implantation undergo less absorption in a given time than unused tablets. It has now been found that this also applies to tablets which have been incubated in blood plasma, and, what is most significant, in distilled water. It thus seems that the reduced initial absorption on re-implantation must be due to the loss of the labile fraction during the previous implantation and not, as was once believed[3], to the presence of a pre-formed ghost in the tablet.

In consequence of the labile fraction, absorption curves for 1,000 mgm., 500 mgm. and 250 mgm. tablets in the bovine, goat, rabbit, rat, guinea pig and pigeon show two phases. There is an initial phase of rapid absorption, after which the curves bend sharply and absorption proceeds at a linear, but reduced, rate. The linear section of such a curve makes, on extrapolation, a positive intercept on the vertical (absorption) axis, from which the weight of the labile fraction may be estimated. On the other hand, curves for 50 mgm., 25 mgm. and 15 mgm. tablets in the rat are linear and pass through, or very near, the origin.

Because of ghost formation, apparent absorption values, determined by weighing tablets before and after implantation, are in all cases lower by the weight of the ghost than the true values. On extrapolation, therefore, true absorption curves make larger intercepts on the vertical axis than apparent

urves. The true absorption curves for small tablets in the rat are thus probably of the same form as those for larger tablets, though here the difference made by the ghost correction has been found to be much less than for large tablets. Even after application of the ghost correction, such curves make only small intercepts on the vertical axis, indicating that for reasons at present unknown, the labile fraction is less important in the smaller classes of tablet than in tablets weighing 250 mgm. and upwards.

The characteristic absorption rate for tablets of any given weight is represented by the slope of the absorption curve during the linear phase. Absorption rates per mm.² of tablet surface, for tablets of various sizes implanted in different animals, were approximately constant, provided that the tablets were not too large in relation to the size of the animal, showing that absorption rate is proportional to surface area. In the rat, the linear absorption rate of large tablets was found to be either very much reduced (500 mgm. tablets) or zero (1,000 mgm. tablets), possibly because of saturation of the body fluids or local tissues with oxycestrol absorbed during the initial phase.

These experiments, which will be more fully described elsewhere, show that ghost formation is not responsible for the fall in absorption rate observed with large tablets shortly after implantation, but provide no answer to the question whether or not the presence of the ghost has any influence on the linear absorption rate.

S. J. FOLLEY.

National Institute for Research in Dairying, University of Reading. July 3.

[1] Folley, S. J., NATURE, 150, 403 (1942).
[2] Bishop, P. M. F., and Folley, S. J., unpublished observations.
[3] Folley, S. J., NATURE, 150, 735 (1942).

Propagation of Potato Seed Tubers from Stems

MENTION has been made by Dr. N. Polunin[1] of the practice of propagation of potatoes for seed tubers from what are described as 'tops'. This work has been developed in the U.S.S.R. recently by Prof. Lysenko. The method was employed in Great Britain during the War of 1914–18, though on a smaller scale. The term 'tops' has caused some confusion among British workers, for it refers to the severed rose or top ends of large-size tubers and not, as might be supposed, to the aerial stems of the plant. Tops, shaws or haulms are common names in Great Britain for the stems and thus a wrong impression has arisen.

Propagation for seed tubers is possible, however, from pieces of the aerial stems, and my observations are given below because they may be of value where there is a critical need for the largest quantity possible of seed tubers, as in the U.S.S.R. It is also desirable for breeders of potatoes to multiply the stocks of a new and valuable variety at as great a rate as possible without causing any deterioration in vigour.

When early varieties such as Arran Pilot are lifted, in June or early July, the strongest and healthiest stems are collected and treated in the following manner. The roots and the tip ends are cut off with a sharp knife, the leaves are also stripped by the same means, but any small axillary shoots are left. The stem is then cut transversely into two separate halves, so that each half possesses not less than three nodes. If these stem pieces are planted in moist soil at a depth of about 5–7 cm. they will give rise to small plants and to a crop of seed-size tubers before winter. The stem pieces are, however, susceptible to attacks by slugs and should be treated with a suitable deterrent where these pests are present.

In the course of this work it is observed that, if the axillary shoots are removed or if they are very minute, small tubers of a perfectly normal appearance develop in the axils in about ten days. This occurs not only in the soil but also where the stem pieces are left in the dark, in boxes and in a cellar preferably covered by damp sand or moss. Growth is continuing after three weeks and there is reason to suppose that the majority of the tubers will reach the size of chats, which are often planted in the field in Great Britain.

This latter method presents possibilities for the propagation of second early and maincrop varieties, where it is too late in the season, when they are lifted, for the stems to be replanted in the earth. Darkness appears to be essential to normal tuber formation and it is necessary to avoid any place which is too damp and badly ventilated or, on the other hand, too dry. The former condition may cause rotting and the latter a shrivelling of the stem piece.

Investigations are still in progress, but it is desirable that the matter should be made known before the present season is too far advanced for others to try these methods.

G. H. BATES.

The Farm Institute, Penkridge. July 13.

[1] NATURE, 151, 421 (1943).

Distribution of Catalytically Active Centres on Surfaces

THE autopoisoning of catalytically active copper in dehydrogenating ethyl alcohol above 280° C., previously reported[1], has been further studied. Assuming a linear law of variation of the velocity constant k_ε of the poisoning with the heat of activation ε on the distribution[2] of centres of activity on the surface over the narrow range of values of ε which determine the reaction velocity in the form

$$k_\varepsilon = k_0(a + b[\varepsilon - \varepsilon_1]),$$

where ε_1 is the lower limit of the value of the heat of activation, the equation for the decay of reaction velocity with time in the auto-poisoning of the distribution of active centres becomes

$$v_t = v_0 \frac{e^{-\alpha t}}{1 + \beta t},$$

where $\frac{\beta}{\alpha} = \frac{b}{a\lambda}$, and λ is the exponential factor giving the decrease in the reactivity of centres with heat of activation as the heat of activation rises over the distribution.

Now $\lambda = \frac{1}{RT} - \frac{1}{k}$, or according to Cremer and Schwab[3], $\lambda = \frac{1}{RT} - \frac{1}{RT_\varepsilon}$, where T is the absolute temperature of reaction, and T_ε is the absolute temperature at which the groups of atoms with strong external fields are frozen in equilibrium. Thus

$$\frac{\beta}{\alpha} = \frac{b}{a\left(\frac{1}{RT} - \frac{1}{k}\right)} = \frac{bR\,TT_\varepsilon}{a(T_\varepsilon - T)},$$

giving in the region of temperature below T_0, provided $\frac{\beta}{\alpha}T$ does not change appreciably, that $\frac{\beta}{\alpha}(T_0 - T)$, that is, β/α multiplied by the difference in centigrade temperatures, should be approximately constant, or that the ratio should rise rapidly on approaching the apparent temperature at which the groupings of atoms have been frozen.

Measurements of the rate of dehydrogenation in this region have given the following preliminary results :

(*a*) the formula fits the curves reasonably closely ;
(*b*) both α and β and the ratio β/α rise as the temperature of reaction increases towards T_0 ;
(*c*) the product $\frac{\beta}{\alpha}(425 - T°\ \text{C.})$ is approximately constant.

Temperature (T °C.)	α/2·3	β/2·3	β/α	$\frac{\beta}{\alpha}(425-T)$
300	0·00309	0·00524	1·73	216
350	0·00541	0·01648	3·04	228
365	0·01285	0·04505	3·56	214

The results are also suggestive in that the apparent rise in the heat of activation appears to be shown in the α and β constants themselves. The active surface in these experiments appears to have been frozen at a temperature of 425° C., which gives a value of $1/h = 7{\cdot}2 \times 10^{-4}$ in the formula

$$\delta n = Ae^{\alpha/h}\delta\varepsilon ;$$

this compares with a mean value of $6{\cdot}6 \times 10^{-4}$ directly measured in previous experiments[2].

The positive sign of β in the results leads to the conclusion that the more active centres poison more slowly than the less active ones. Further work is proceeding, but it does appear that this is a rare case in which information about the distribution of active centres may be obtained from measurements of the decay of reaction velocity at a series of temperatures in the region below T_0.

I beg to acknowledge with thanks a grant from the Dixon Fund of the University of London. A full account will be published later.

F. H. CONSTABLE.

St. Johns, Cashio Lane, Letchworth, Herts.
June 16.

[1] Constable, *J. Chem. Soc.*, 2995 (1927).
[2] Constable, *Proc. Roy. Soc.*, A, 108, 355 (1925).
[3] Cremer and Schwab, *Z. physik. Chem.*, A, 144, 243 (1929). Schwab, *Z. physik. Chem.*, B, 5, 406 (1929). Cremer, *Z. physik. Chem.*, A, 144, 231 (1929).

Marine Biology in the West Indies

IN his recent communication[1] in which he urges the establishment of biological research stations in the West Indies, Dr. V. J. Chapman has raised a matter of prime interest to all British biologists. My interests are in marine biology but, before proceeding to elaborate the arguments for the establishment of a centre of marine research in the West Indies, it may be stated in general that the ideal training of all biologists should include some experience of tropical conditions. This has long been recognized in the United States, where admittedly access to tropical regions has been easier. But in days when hundreds or thousands cross the Atlantic weekly by air, Great Britain is effectively little farther from the West Indies than are the northern and western areas of the United States. We are promised great colonial development after the War and this project of Dr. Chapman's, whereby the universities of Great Britain can co-operate in the prosecution of fundamental biological research in the West Indies (and, it may be hoped, farther afield also), is one of the obvious ways in which this development may be furthered.

Marine biological research in the southern North Atlantic has suffered a considerable setback owing to the closing down of the two marine stations at Bermuda and the Tortugas. The former, it is hoped, will be re-established after the War, but its obvious function is the study of the waters of the Gulf Stream and to act as a link between the oceanographical work at Woods Hole and at Plymouth. It is destined to be an important Anglo-American link and would in no way fulfil the functions of, or in any way compete with, a marine station in the West Indies.

With the abandonment by the Carnegie Institution of its laboratory at the Tortugas there is now no centre of marine research in the Gulf of Mexico or in the Caribbean Sea. It is well known that, but for the untimely death of Dr. A. G. Mayor, this station would probably long ago have been transferred to some more accessible site. Dr. Mayor certainly hoped to see it transferred to Montego Bay in Jamaica (one of the sites suggested by Dr. Chapman in his letter). Whether the Carnegie Trustees have any plans for the continuance of tropical marine research after the War remains to be seen ; but it is at least possible that they might be prepared to co-operate in the establishment of a station in Jamaica.

The possibilities of a tropical marine station readily accessible to British workers are great indeed. It was the common impression of all my colleagues on the Great Barrier Reef Expedition that our intensive year of work, when we attempted in the time available to apply the methods of Plymouth and of Millport to the study of coral reefs, did little more than reveal to us the endless diversity of problems that the conditions of tropical marine life present to the inquiring mind. The diversity of forms of life, and often the size of individual species, are much greater in tropical waters ; the speed of development and growth and the intensity of environmental factors greater than in temperate seas.

It is hoped that after the War the Colonial Office will establish a fisheries service. It will need a station in the West Indies, but more than that it will want a centre for the training of fisheries officers for services elsewhere in the tropical Atlantic and in the Indian and Pacific Oceans also. Where better than in the West Indies, where direct contact could be maintained with the parent British institution at Plymouth and also with the British universities ? Moreover, a colonial fisheries officer is none the worse for some knowledge of the characteristics of the terrestrial fauna and flora of the tropics which could be obtained from the land station which Dr. Chapman also suggests should be established.

Strong support, it is felt, should come from British universities for this project. Here, at Bristol, we have historical connexions with the West Indies and still retain the major part of its now diminished trade. Although I write this letter in a purely private capacity I am confident that any appeal made to the universities on this matter would find here a particular welcome and response.

Department of Zoology, C. M. YONGE.
University,
Bristol, 8.
July 16.

[1] NATURE, 152, 47 (1943).

EDUCATION AND TRAINING FOR ENGINEERS

ON March 19, 1942, a paper entitled "A Critical Review of Education and Training for Engineers" was read in London before the Institution of Electrical Engineers by Dr. A. P. M. Fleming. The paper was prepared by a sub-committee of the Post-War Planning Committee of the Institution, with Dr. Fleming as its chairman, and it received an extended notice in NATURE of May 2, 1942 (p. 482). Based on this paper and the subsequent discussions, a 22-page report on "Education and Training for Engineers" has now been issued by the Post-War Planning Committee with the authority of the Council of the Institution, with the expressed hope that it may be of assistance to those concerned in the problems of post-war reconstruction in Great Britain.

Dealing first with craftsmen and foremen, it may be said that there is general agreement on the need for measures which will lead to improvement in the status of the craftsman. To this end the following recommendations are made. More care should be exercised in the selection of entrants to craft training courses. This should be the responsibility of panels representing wider interests and experience than those of the employer alone. There should be a probationary period for all craft apprentices during which provision would be made for transfer to more suitable employment where necessary. The apprenticeship should commence with a period in a special apprentice workshop where the elements of the craft would be acquired under the guidance of experienced instructors. Where possible, these workshops should be a part of the industrial organization, but co-operation of the local technical colleges will be necessary where this is impracticable. Subsequent practical training should be organized, and definite responsibility for the training course should be accepted by each employer. Part-time day release should be granted for general education and for vocational instruction. The combination of workshop and classroom instruction should be organized on nationally recognized lines and a 'craftsman certificate' should be instituted. Subsequent part-time courses should be provided leading to certification for foremanship. The school-leaving age should be raised, and the full-time education received up to this age and the part-time education received afterwards should both be planned on as broad a basis as possible. Thus every facility would be afforded for development, not only in the craft or trade but also in the best use of leisure; and transfer to other types of work would be simplified for the man who so desires.

As to student apprentices, this title is intended to cover those whose practical training and technical education are combined on a part-time basis, who will become draughtsmen, designers, etc., and may attain some of the highest executive positions. For such it is recommended that organized schemes of practical training should be instituted, or participated in, by all employers of student apprentices, and that recognized national standards should be established. Part-time day release for study, both general and technical, should be compulsory, and this release should be for not less than one full day per week. Attention to technical matters at the expense of the study of broad scientific principles should not be permitted in the early stages of the course. Some part-time evening instruction should also be available, but this should not be made compulsory. The present schemes of Ordinary and Higher National Certificates should be continued and developed and should form an integral part of student apprenticeship. Consideration should be given to making teaching in technical schools, institutes and colleges more attractive as a profession. The facilities which are available for technical teachers to return to industry for short periods, to renew their industrial experience, should be extended. Technical teachers should receive instruction in the art of teaching.

For university trainees it is recommended that full-time university courses should be made available to anyone who has the ability to obtain full benefit from them. There must be no financial barrier to entry. Schemes similar to the present State bursary scheme should be implemented after the War, provision being made for increased transfer from National Certificate to university courses. University engineering schools should cease to treat all students as potential high-grade scientific or technical workers; those who are not should receive instruction in economics, law and social science in place of the more advanced technical instruction. It is the duty of the university to equip men for leadership and not merely to impart advanced technical and scientific knowledge. University engineering students should devote part of the two shorter vacation periods to tutorial classes and part of the longer vacation period to the acquisition of practical experience. A period of the order of one year should be spent in gaining experience of industry before proceeding from school to the university. All university engineering graduates should be given a course of practical training of a broad character.

Lastly, in respect of 'post-advanced' students it should be remarked that the professional engineer must acquire specialized knowledge of the branch of engineering in which he is engaged, and the university graduate must acquire practical experience before he is able to apply his academic knowledge usefully. To this end it is recommended that postgraduate work at universities should be further developed, and that 'post-advanced' courses of lectures by recognized authorities should be provided locally on specialized branches of engineering practice. Technical colleges should extend the provision of 'post-advanced' courses in such subjects as economics, workshop organization and management, industrial management and business practice. These and similar subjects should be studied when the student is sufficiently mature to appreciate them and is likely to be able to make use of them. This is particularly important in the training of men who have been selected as potential executives. Such men should also be afforded opportunities of acquiring experience in administration.

Subsequent to the above recommendations, the report presents the bases upon which they are made, these being as follows: an outline of the pre-war engineering education and training system for England and Wales, and the essential elements of a satisfactory post-war system, which latter embody vocational guidance and selection, training of engineers, training of craftsmen, and the selection and training of teachers.

In its concluding paragraph, the report strikes the real keynote of success, urging that "the progress of engineering—in fact that of any human activity—depends on personnel. It is therefore essential

in the national interest to secure the proper recruitment and training of personnel for the engineering industry, not only for the higher professional ranks but also for every grade of worker. It should be a fundamental principle in dealing with engineering personnel to ensure that every individual is so trained that, whatever the work on which he is employed, he can give service in the most efficient manner possible".

SCIENCE IN SOVIET RUSSIA

IN his account of "Science in Soviet Russia" in the Trueman Wood Lecture before the Royal Society of Arts on April 14, Mr. J. G. Crowther said that the place of science in Soviet philosophy is the most important motive in the development of science in the Soviet Union.

Reviewing the development of the new physical research institutes, Mr. Crowther pointed out that these were not built until the men to run them had already been trained. Following that of the Ukraine opened at Kharkov in 1930, others were founded at Dniepropetrovsk, Sverdlovsk, Tiflis and other centres. The existence of these new scientific institutes, especially in the east, has been of great importance during the present War. Sverdlovsk, for example, received important sections of the Soviet Academy of Sciences when Moscow was threatened. The new institutes have special lines of research appropriate to the needs of the locality. The Physico-Technical Institute at Kharkov had large research departments in high-tension physics and low-temperature physics. At Dniepropetrovsk and Sverdlovsk, special attention was given to metallurgy, the latter Institute serving the scientific needs of the metal industry of the Urals.

In the planned development of science in the U.S.S.R., Mr. Crowther said that at least as much importance is attached to human as to natural resources, and the founding of special institutes for men of outstanding ability has been a feature of it. In such planning, the importance of the Academy of Sciences has steadily increased and it is now directly responsible for this work to the Supreme Soviet. The Academy determines the general lines of scientific work in accordance with the needs of the State and possibilities in subjects and personalities. It sees that balanced attention is given to all sides of science, that no important branches are neglected and overlapping is reduced. Moreover, such planning is a mutual process of adjustment in which ideas flow equally from the top and the bottom.

The plan of research for 1943 is mainly directed to the improvement of war industries and armaments (see NATURE, January 30, p. 129). Geologists and geographers are engaged on the exploration and study of new sources of oil, ores and minerals, especially in the Urals, West Siberia, Kazakhstan and the Middle Volga regions. Agricultural science will be devoted to efforts to increase the yield of cereal and industrial crops such as rubber-bearing plants, potatoes and beet. Technologists are to develop the use of industrial gas and the gasification of new forms of fuel, so that local fuels can be utilized and long hauls reduced, in addition to research on aircraft, radio, weapons, etc.

After a brief account of some of the achievements of Soviet science, Mr. Crowther said that the spirit of the Soviet men of science rather than the impressive number and equipment of Soviet scientific institutions is the chief quality of Soviet science. The atmosphere of youth is striking and the planning of the research and the relation of the work of the Institutes to industrial and political affairs are the subject of continuous organized discussion. One of the achievements of Soviet technology has been the provision of an immense body of good technical officers for the Red Army. The problem of social relations between the scientific and the ordinary worker has largely been solved, and the scientific worker has great prestige due to philosophical and practical reasons, and he is relatively well paid, enjoying also special holiday facilities as well as the health and education services available to every Soviet citizen.

TIMIRIAZEV CENTENARY CELEBRATIONS

ON June 3, the hundredth anniversary of the birth of the Russian naturalist and plant physiologist, Klimenty Timiriazev, was celebrated throughout the Soviet Union, special celebrations being held in Moscow.

Timiriazev was a member of an impoverished noble family living in St. Petersburg. The interest which Darwinism excited in him while he was a student persisted throughout his life. In 1864 he published three articles about Charles Darwin and his teachings. In 1870 he was elected to the chair of botany at St. Petersburg Agricultural Academy and in 1877 he became, in addition, professor in the University of Moscow, where he lectured on the anatomy and physiology of plants. He was the author of many scientific works which have now been issued as a twelve-volume complete edition. Timiriazev devoted fifty years of scientific activity to the study of photosynthesis. His work was marked by exactitude, perfection being his constant aim, and his improvements in technique won the admiration of many scientific men.

The main problem of Timiriazev's scientific work was the occurrence of photosynthesis in relation to regions of the solar spectrum—a problem further worked on by A. Richter, V. Lubimenko, and A. Danilov. Timiriazev established the fact that disintegration of carbon dioxide proceeds most intensively under the influence of red light. Proceeding from the principle that accumulation of dry plant matter reaches its maximum in the blue regions of the spectrum, Danilov has extended Timiriazev's work to show certain relationships in aquatic plants. Timiriazev was also interested in the pigmentary apparatus of photosynthesis. He also investigated field ecology; and the urge that incited even his most academic work was the practical aim of helping the farmer, and thereby the people at large.

Timiriazev lived to see only the first two years of the Soviet Revolution, of which he declared himself to be a warm supporter. He not only left several brilliant students including Dmitri Prianishnikov, Sergei Kostichev, and his son Prof. Arkady Timiriazev, but also acquired a remarkable reputation throughout Russia as a popularizer of science. Maxim Gorky asked how it was that in some snowy hamlet of the Kherson province, or so far away as Perm, Timiriazev was known, and his books frequently asked for. Timiriazev's support of the Darwininn theory has ensured popularity for it in Russia.

These facts have emerged from accounts of the centenary sent to us by Profs. Alexander Schneiderman, Alexander Popov, Nikolai Williams, B. Shiskin, and others.

The Moscow centenary meetings included one held at the Timiriazev Agricultural Academy (the oldest agricultural school in the Union) at which Alexander Paramonov read a paper on "Timiriazev as the Founder of Russian Darwinists", and others spoke on botanical problems. At a meeting in the Moscow Scientists' Club, there were present members of the Academy of Sciences of the U.S.S.R., the Lenin Academy of Agricultural Sciences, University of Moscow, and others. The Vice-President of the Academy of Sciences, Leon Orbeli, said in an introductory speech that whole generations had been and were being trained on the basis of Timiriazev's classic work "The Life of Plants". The eighty-year-old Victor Krasilnikov followed with a portrait of Timiriazev as a "Knight of Science". Krasilnikov did not simply relate, but re-lived the past, and mentioned that one of Timiriazev's aims had been the creation of hundreds of experimental fields in every province. Timiriazev's activity did not find much practical support in pre-revolutionary times, but Trofim Lysenko pointed out that much of the present Russian drive for increased agricultural production could be ascribed to the spirit of Timiriazev. At this meeting, congratulatory telegrams were read from the Royal Society, the Royal Agricultural Society of England, and Rothamsted Experimental Station.

The Timiriazev Agricultural Academy is indeed playing a great part in Soviet agriculture. President Kalinin, chairman of the Presidium of the Supreme Soviet, has expressed the desire that the influence of the Agricultural Academy should be extended to collective farms throughout the country and should embrace all cultivation. Important steps in such extension work have already been made in many districts in European and Asiatic Russia.

In 1903 Timiriazev gave the Croonian Lecture, and eight years later was elected foreign member, of the Royal Society. He was also doctor *honoris causa* of the Universities of Cambridge, Glasgow and Geneva, and was a member of the Edinburgh and Manchester Botanical Societies. These foreign memberships were and are a source of much pride to the Russian people, and Timiriazev's statue in the centre of Moscow shows him robed in a Cambridge gown.

CARNEGIE INSTITUTION OF WASHINGTON

YEAR BOOK No. 41 of the Carnegie Institution of Washington covers the year July 1, 1941–June 30, 1942, and in addition to the reports of the executive committee, the auditors and the president, includes the reports of the departmental activities and co-operative studies. In regard to war activities, the president states that the policy of the Institution, in carrying on war research for the Government, has been to contribute the use of its facilities, the services of its regular scientific staff and its regular overhead costs of providing administrative services and the like. The Institution is reimbursed for all additional out-of-pocket expenses directly attributable to the research for Government. In addition, it has loaned the services of some of its scientific personnel while retaining them on the pay-roll. In regard to finance, the favourable financial situation of the Institution which existed for three decades no longer persists, and for the first time in the history of the Institution the budget involves even a small predicted deficit. There is still some room for retrenchment, and a deficit appears for one reason because the annual grant from the Carnegie Corporation of New York is carried in a separate account since it is of a terminating nature. The downward trend of income from 1,695,900 dollars in 1936 to an estimated income of 1,175,000 dollars for 1943 if continued will, however, soon involve retrenchment of the regular operation of the departments.

Among the results of many investigations undertaken at the Mount Wilson Observatory, special reference is made to the increase in our knowledge of solar prominences, solar rotation and the general magnetic field of the sun through the application of powerful interference methods; to the analysis of the gaseous clouds of interstellar space and to the probable solution of the long-standing problem of the direction of rotation of the extragalactic spiral nebulæ. Activities of the Geophysical Laboratory and the Department of Terrestrial Magnetism have been directed so exclusively to war research that there is little to report. Priorities have, however, now been obtained for the materials necessary to complete the cyclotron at the Department of Terrestrial Magnetism, which is expected to be available for use during the coming winter. In the field of terrestrial sciences a number of reports of work on cosmic ray research at the Universities of Chicago and New York, the California Institute of Technology and elsewhere are included.

In the Division of Plant Biology further work has been carried out on the variables of the photosynthetic processes, structural elements in the higher plants and differences and relations in climatic races of flowering plants. Several projects have been completed on the influence of a desert environment on plant-growth, and it has been discovered that diatoms and related plants contain chlorophylls which are different from those of land plants. The Department of Embryology has continued its work along previous lines, and knowledge of the development of the human embryo has been pushed back about one week to the eighth day of gestation. Effective co-operation has been continued between the Department of Genetics and the Long Island Biological Association at Cold Spring Harbor. Detailed studies at the Department of Genetics of genetic effects caused by X-rays, ultra-violet rays and neutrons show consistent differences between the action of these radiations. Compared with gene mutations, fewer chromosomal breaks are caused by ultra-violet radiation than by X-rays, whereas the neutrons show a higher rate of chromosomal breaks than X-rays. Nearly six years study of the role of hormones in the regulation of the maternal instinct in rats has been completed by Dr. Riddle and his associates, who have found that the pituitary gland hormones play an important part in the production of stimuli that result in unlearned maternal behaviour. The Department has also co-operated with the Bureau of Plant Industry and the U.S. Department of Agriculture on problems arising from the war emergency, and is experimenting with the rubber-producing Russian dandelion and with fibre-producing hemp.

The small staff of the Nutrition Laboratory has been engaged in important war research in co-operation with groups at the Harvard Medical School. Projects under the Division of Historical Research have been of interest in supplementing the Government's programme of inter-American cultural relations. The knowledge possessed by the staff members of this Division with regard to geographical and economic conditions in Central America is also proving of assistance in connexion with the Government's war programme.

ACID NEUTRALIZATION IN INSULATING PAPERS

IN the manufacture of paper-insulated condensers, impregnating materials are used to eliminate air pockets and to increase the dielectric capacity of the paper. With long use, particularly at high temperatures and under high voltages, traces of hydrochloric acid are liberated from chlorinated impregnants. The acid, and the salts formed by its reaction with the metal electrodes, ultimately decompose the paper and break down the condenser. This destruction is delayed by calcium, magnesium and other metals combined chemically with the paper which neutralize the hydrochloric acid.

An article by D. A. McLean (*Bell Lab. Rec.*, 21, No. 6; Feb. 1943) gives some of the results of an investigation carried out on the properties of Kraft and linen papers. Exchange reactions in cellulose materials do not take place in the principal constituent but in other organic materials with which cellulose is always associated, including lignin, pectic substances and pentosans. Differences in content of these minor components explain why papers differ so greatly in exchange capacity. Kraft paper, which is much superior to linen for condenser insulation, has several times the exchange capacity of linen tissue. In apparatus with which accelerated life-tests of condenser papers are carried out, condensers are heated in an oil bath and a continuous record made of the leakage current until the paper under test breaks down.

When aluminium electrodes are used in condensers made with paper impregnated with chlorinated compounds, decomposition of the dielectric proceeds from central nuclei about which the paper becomes partially carbonized. If the sample is dismantled after accelerated tests at high temperature and with D.C. voltage, these areas can be seen as brown spots. Under ordinary artificial light a photograph shows dark spots on a light background, but with ultra-violet light the spots fluoresce brightly.

Papers of high exchange capacity are capable of suppressing the formation of decomposed areas, and in two samples taken from a condenser after approximately equal periods of test at the same voltage, linen paper is shown to become thickly populated with decomposed areas which have grown from minute centres seen scattered through the sample, whereas Kraft paper shows only slight evidence of decomposition. More severe conditions of test are required to produce serious deterioration in the Kraft paper.

Superiority of Kraft paper as a dielectric is illustrated by comparing the energy losses at elevated temperatures in condensers made with this material and with linen. The lower power factor in Kraft paper is due to the binding of ionic material by its base exchange properties, which decreases the A.C. losses. Values given in the article were determined at low potential gradients, under which conditions ionization is most readily detected by A.C. measurements. Condenser papers of high exchange capacity reduce leakage current, and typical results obtained with linen paper under accelerated test conditions show a rapid increase of leakage and dielectric failure after 40 hours. In contrast, Kraft paper has a much more stable leakage current and a life of 350 hours, as its high base exchange capacity suppresses decomposition. These studies of exchange reactions in condenser papers impregnated with chlorinated compounds have led to the development of stabilizers which extend the life of condensers, under stated severe test conditions, to several thousand hours.

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

HEAD OF THE ELECTRICAL ENGINEERING DEPARTMENT—The Registrar, Technical College, Sunderland (August 6).

LECTURER (MAN OR WOMAN) IN CHEMISTRY in the Croydon Polytechnic—The Education Officer, Education Office, Katharine Street, Croydon (August 6).

SPEECH THERAPIST (full-time)—The Secretary for Education, Education Offices, York (August 6).

GRADUATE ASSISTANT MASTER to teach ENGINEERING DRAWING at the Middlesbrough Technical School for Boys—The Director of Education, Education Offices, Middlesbrough (August 7).

TEACHER OF MINING SUBJECTS in the Denbighshire Technical College, Wrexham—The Director of Education, Education Office, Ruthin (August 7).

ASSISTANT MASTER (preferably a Graduate with works experience) to teach TECHNICAL DRAWING AND MATHEMATICS in the Sunderland Junior Technical School—The Director of Education, Education Offices, Carlton House, Mowbray Road, Sunderland (August 9).

ASSISTANT to teach MATHEMATICS and other Junior Engineering Subjects—The Principal, County Technical College and School of Art, Newark, Notts. (August 9).

LECTURER IN MATHEMATICS in the Constantine Technical College, Middlesbrough—The Director of Education, Education Office, Middlesbrough (August 14).

HEAD OF THE DEPARTMENT OF CHILD DEVELOPMENT in succession to Dr. Susan Isaacs—The Secretary, University of London Institute of Education, at University College, Nottingham (August 14).

LECTURER (TEMPORARY) IN PHYSICS—The Acting Secretary, University Court, The University, Glasgow (August 15).

ASSISTANT LECTURER AND DEMONSTRATOR IN THE PHYSIOLOGICAL DEPARTMENT—The Secretary, The University, Birmingham (August 18).

LECTURER (TEMPORARY) IN CHEMISTRY—The Registrar, University College, Southampton (August 25).

PROFESSOR OF PHYSIOLOGY, A SENIOR LECTURER IN ANATOMY, and A SENIOR LECTURER IN PHYSIOLOGY, in the University of Otago, Dunedin—The High Commissioner for New Zealand, 415 Strand, London, W.C.2 (August 31).

CHEMIST AND ASSAYER on the establishment of the South African Mint, Pretoria—The Secretary, Office of the High Commissioner for the Union of South Africa, South Africa House, Trafalgar Square, London, W.C.2 (August 31).

HEADS OF THE DEPARTMENTS OF PHYSIOLOGY, MEDICINE, and SURGERY—The Bursar, Royal Veterinary College and Hospital, The University, Reading (October 1).

CHAIR OF NAVAL ARCHITECTURE—The Acting Secretary of University Court, The University, Glasgow (October 4).

ENGINEERING WORKSHOP INSTRUCTOR for service in the Bury Junior Technical School and Bury Municipal Technical College (Evening Classes)—The Director of Education, Education Offices, Bury.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Young Workers and their Education: Providing the Right Type of Education and Problems of Release from Work. A Report of a Conference held at the College of Technology, Manchester, April 15, 1943, under the auspices of the British Association for Commercial and Industrial Education. Pp. 40. (London: British Association for Commercial and Industrial Education.) 1s.

Geological Survey of Great Britain: England and Wales. Wartime Pamphlet No. 33: Glauconite Sand of Bracklesham Beds, London Basin. By Dr. Kenneth P. Oakley. Pp. 28. (London: Geological Survey and Museum.) 1s. 6d.